PROCEEDINGS

OF THE

Bournemouth Natural Science Society.

VOL. XXXIII.

SESSION 1940-41.

NATURAL HISTORY

PROCEEDINGS of the

Bournemouth Natural Science Society.

VOL. XXXIII.
SESSION 1940-41.

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Introductory Note.

The objects of the Society are declared by the second of its rules to be " the promotion of the study of Science in all its branches, by means of Lectures, Field Meetings, the Reading and Discussion of Papers, and the formation of Sections of its members devoted to any particular branch of the Society's work, and in any way that the Council of the Society shall deem advisable."

The Sections at present working are as follows:—**Archæological and Historical, Astronomical, Botanical, Entomological, Geographical, Geological, Microscopical, Photographic, Physical, and Zoological.**

During the **Winter Session,** from October to April, GENERAL and SECTIONAL MEETINGS are held, comprising Lectures and Demonstrations on subjects of scientific interest, illustrated by lantern slides, diagrams, specimens or experiments.

All meetings are open to all members of the Society.

Throughout the **Summer Session,** EXCURSIONS to places of interest in the neighbourhood are arranged, and indoor or garden meetings occasionally held.

The management of the Society is vested in a Council, which is elected at the Annual General Meeting, held in October.

The Society possesses a Library available for the use of members. This is yearly becoming more extensive and valuable by the acquisition of standard text books and of books dealing with matters of local scientific interest. Books may, under certain conditions, be borrowed by members, and there is a Reading Room in which works of reference may be consulted.

Members are elected by the Council and pay an annual subscription of £1 for full membership (admitting to all meetings and excursions for the year), a subscription of £2 covers four adult members of the same family residing in the same house.

Notices, giving full details of all meetings, etc., are posted to every member, and a volume of Proceedings is published each year.

Application Forms for Membership, and further particulars, can be obtained from the

HON. SECRETARY,
Bournemouth Natural Science Society,
39 Christchurch Road,
Bournemouth.

Bournemouth Natural Science Society

OFFICERS AND COUNCIL, 1941-42.

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H. de Castro
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Mrs. M. G. James
Rev. Prof. M. C. Potter, M.A., D.SC.
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H. J. Wadlow
Mrs. W. Boyd Watt, M.B.O.U.
G. G. Wren

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Astronomical : Instr.-Capt. M. A. Ainslie, R.N., M.A., F.R.A.S.
Botanical : L. Beeching Hall, F.L.S.
Entomological : S. C. S. Brown, L.D.S., R.C.S.
Geographical : W. J. Woodhouse, A.C.P.
Geological : Henry Bury, M.A., F.L.S., F.G.S.
Microscopical : E. A. Robins, F.R.P.S., F.L.S., F.R.M.S.
Photographic : S. Whitaker.
Physical : Miss M. Penrose, B.SC.
Zoological : Mrs. W. Boyd Watt, M.B.O.U.

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S. Whitaker.

Hon. Editor

Miss M. Penrose, B.Sc.

Hon. Curator

W. C. Simmons, B.Sc., A.R.C.S., F.G.S.

Hon. Auditors

F. Broad, F.S.I., J. C. Woods.

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National Provincial Bank of England, Bournemouth.

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The Hon. Secretary (W. J. Woodhouse)
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G. Brumell
J. Cameron
Miss M. Penrose
W. C. Simmons
S. Whitaker
G. G. Wren

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F. Broad
G. Brumell
L. Beeching Hall
S. Whitaker (Librarian)

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Chairman of Archæological Section (F. L. Lowther).
Chairman of Botanical Section (L. Beeching Hall).
Chairman of Entomological Section (S. C. S. Brown).
Chairman of Geological Section (H. Bury).
Chairman of Zoological Section (Mrs. Boyd Watt).
E. St. J. Burton, F.G.S., F.R.S.A.
W. G. Aitchison Robertson, M.D., D.Sc.

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The Hon. Editor (Miss M. Penrose).
The Hon. Secretary (W. J. Woodhouse).
The Hon. Treasurer (A. J. Parsons).
Henry Bury.
S. Whitaker.

Garden

Chairman of Botanical Section (L. Beeching Hall).
H. de Castro
H. F. Harding
Mrs. James
Mrs. Richards
H. J. Wadlow
R. Watkin
F. L. Lowther (Chairman).

List of Members.

Revised to November, 1941.

* Honorary Members. † Past Presidents.
o Original Members. l Life Members.
a Associate Members.

The year of election is given before the name of each member.

A

1932	Abbott, A. H.	Portman Cottage, 755 Christchurch Road
1932	Abbott, Mrs.	,, ,, ,,
1927	Adkins, H.	Glenavon, 107 Alumhurst Road
1935	Ainslie, Instr.-Capt. M.A., R.N. B.A., F.R.A.S.	Grenville, Talbot Drive, Wallisdown
1933	Andrews, Rev. P. T., M.A.	Foxwold, 34 Belle Vue Road, Southbourne
1937	Ansell, Miss E. M.	53 St. Catherine's Road, Southbourne
1933	Anthony, Miss C. H.	14 Iddesleigh Road
1937	Asquith, Miss K.	6 Huntley Mansions, Boscombe East

B

1939	Bailey, E.	A22, San Remo Towers, Boscombe
1937	Baker, C. A., M.I.E.E.	Shalimar, Leven Avenue
1937	Baker, Mrs. L. M.	,, ,,
1940	Baker, Miss L. R.	Stafford Court, 25 Surrey Road
1936	Banham, Miss	16 Aylestone Road, Cambridge
1912	aBarraclough, A., M.A., F.R.G.S.	93 East Avenue
1936	Barran, Sir Rowland	Lindsay Hall, Lindsay Road
1927	Bater, G. W., B.A.	22 Dingle Road
1939	Bates, T. W.	36 Talbot Avenue
1939	Bates, Mrs. F.	,,
1941	Beattie, Miss E. A., A.R.P.S.	67 Kings Road
1941	Bell, Mrs. R. M.	255 Belle Vue Road, Southbourne
1920	Bennett, Risdon, M.A.	Yew Tree Cottage, Broadstone
1935	lBigg, Mrs. W., CERT. ACC.	24 Poole Road
1937	Bolt, Mrs. R. M.	Shenstone, Westerham Road, Westbourne
1938	Bottomley, Dr. F. C.	1 Beechwood Avenue, Boscombe
1941	Bottomley, H. F.	Lamorna, High Ridge, New Milton
1941	Bottomley, S. E., F.R.P.S.	Seymour Sea, Dorset Lake Avenue, Parkstone
1929	Bourdass, Miss A.	7 Beaulieu Road
1929	Bourdass, Miss F.	,,
1920	aBourne, Miss C. M.	Lynn, Suffolk Avenue, Christchurch
1930*	†Bower, Prof. F. O., D.SC., F.R.S	2 The Crescent, Ripon
1940	Boyle, P. L.	1 Newton Crescent, Parkstone
1940	Bramall, Mrs. F. E.	The Grey House, 46 East Avenue
1926	Broad, F., F.S.I.	Manton Villa, 2 Oxford Road
1921	Bromley, Miss	81 Lansdowne Road
1917	Brown, Mrs. Edward	18, Glen Road, Boscombe
1937	Brown, S. C. S., L.D.S., R.C.S., H.D.D.	Kingsholme, 454 Christchurch Road, Boscombe
1940	Brown, W. D. H.	12 Clifton Road, Parkstone

1905	*Brumell, G., A.R.I.B.A. Hon. Member 1933	Maori, 86 Richmond Park Avenue
1920	Brumell, Miss M.	,, ,, ,,
1941	Bryan, Miss C. I.	86 Overcliff Drive, Southbourne
1920	Bryant, Miss M.	Sunnyhill, Hampden Lane, W. Southbourne
1929	Buckingham, H.	Chester House, Chine Crescent
1939	Buckingham, Miss D. G.	,, ,,
1937	Bunce, Miss A.	25 Parkstone Avenue, Parkstone
1937	Bunce, Miss F.	,, ,,
1929	Burge, J. T.	Glenhurst, Braeside Road, West Moors
1934	Burroughs, Mrs. I. F.	High Bank, Braidley Road
1937	Burrow, Mrs. D. M., B.SC., PH.D.	107 Alumhurst Road
1922	Burton, E. St. J., F.G.S., F.R.S.A.	St. Anne's, Seaward Avenue, Barton-on-Sea
1922	†Bury, Henry, M.A., F.L.S., F.G.S.	The Gate House, 17 Alumdale Road
1930	Bury, Miss G. E.	,, ,, ,,
1930	Bury, Miss G. J.	,, ,, ,,
1940	Bynner, Miss C. F.	10 Aylesbury Road, Boscombe

C

1928	LCalkin, J. B., M.A.	Wychwood School
1934	†Cameron, J., M.D., D.SC.	Balmashanner, Grove Road
1934	Cameron, Mrs. J., J.P.	,, ,,
1940	Cameron, Miss M. E.	The Outlook, Canford Cliffs
1919	Cardew, R. K., B.A.	Stafford Lodge, 26 Dean Park Road
1939	*†Carpenter, Prof. G. D. Hale, M.B.E., D.M., F.L.S., F.Z.S.	Penguelle, Cumnor Hill, Oxford
1932	Chambers, W. H.	14 Douglas Road, Southbourne
1940	Champion, Miss L.	Manor House Hotel, Manor Road
1941	Child, Dr. F.	58 Bath Hill Court
1912	AChilver, Miss K. M.	2 Shaftesbury Road
1931	Clark, Miss K. E.	15a St. Mary's Road
1941	Clark, Mrs. M. H.	12 Glenroyd Gardens, Southbourne
1936	Clarke, Miss Bertha, M.A.	c/o Barclay's Bank, Warminster, Wilts
1927	*Clay, R. C. C., M.D., F.S.A.	The Manor House, Fovant, Wilts
1933	Collings, T. G.	54 Parkwood Road, Boscombe
1941	Coltar, Miss S. A.	334 Poole Road
1928	Constantine, M. H.	Brendon, Nairn Road
1926	Cooper, H. A.	25 Talbot Avenue
1941	Cooper, Mrs. E. M.	,, ,,
1926	LCooper, J. S.	The Little Red House, Colehill, Wimborne
1940	Couchman, Miss E. E.	Campbell House, Campbell Road, Boscombe
1941	Crabtree, W. R.	12 Glenroyd Gardens, Southbourne
1903	†oCrallan, G. E. J., M.A., M.B., M.R.C.S.	Country House Hotel, Crowborough, Sussex
1922	Crallan, Mrs.	,, ,,
1941	Creswell, Mrs. S. M.	13 Cecil Court, Charminster Road
1935	Cross, Miss F. C.	59 Strouden Avenue
1934	Croucher, Miss J. M.	Little Stanpit, Christchurch
1941	Crowe, Mrs. M. L.	13 Beatty Road
1931	Curgenven, Miss A. J.	6 Suffolk Road
1928	Curtis, E. A., L.D.S.	Holm Dene, Poole Road
1928	Curtis, Mrs.	,, ,, ,,
1928	Curtis, E. J. B., L.D.S.	,, ,,
1903	*oCurtis, W. Parkinson, F.E.S. Hon. Member 1922	17 Christchurch Road

D

1927	Dacombe, J. M. J.	Gosfield Cottage, Winkton, Christchurch
1941	Dailey, Miss K.	134 Western Avenue, Ensbury Park
1933	Daimpré, Rev. I. D. D.	St. Mary's Vicarage, Morden, Wareham
1935	Daimpré, Mrs. G. H.	,, ,, ,,
1941	Dark, Mrs. S.	Cottonwood Hotel, Grove Road
1938	Davies, C. W., M.R.C.S., L.R.C.P.	33 Portchester Road
1938	Davies, Mrs. F. E.	,, ,,
1938	Davies, Miss F. B.	,, ,,
1937	Dawes, Mrs. F. E.	24 Parkwood Road, Boscombe
1941	Deacon, Miss F. A.	Flat 54, Hampshire Court, Square
1930	de Castro, H.	Yarlington, Springdale Avenue, Broadstone
1935	Derry, Mrs. E. H.	Charnwood, Belle Vue Road, Southbourne
1941	de Winton, Miss E.	A, 24 San Remo Towers, Boscombe
1941	Dobson, E.	Heathercroft, Ravine Road, Canford Cliffs
1941	Dobson, Mrs. E. M.	,, ,, ,,
1941	Dobson, Miss P. M.	,, ,, ,,
1910	Dodshon, E., LL.B.	124 Old Christchurch Road
1941	Dowling, Mrs. D. M.	7 Ken Road, Southbourne
1941	Draper, Miss D.	8 Rufford Gardens, Tuckton Road, Southbourne
1940	Druitt, Miss A. M.	99 Lowther Road
1925	Druitt, Miss C. M.	,,
1925	Druitt, Miss C. S.	,,
1941	Duffield, E. J.	39 Leeson Road
1926	Dundee, Mrs.	38 Portchester Road
1921	Dunn-Gardner, R. C.	3 Stanhope Gardens, S.W.7
1941	Durham, Lt.-Col. J. A.	40 Canford Cliffs Road

E

1936	Edwards, Charles, M.D.	Lyndon Lodge, 51b Christchurch Road
1936	Edwards, Mrs. H.	,, ,, ,,
1935	Elgar, Rev. A. J., F.Z.S.	Forest House, 1 Grove Road
1935	Elgar, Mrs. E. M. K., F.R.G.S.	,, ,,
1935	Elgar, Hugh	,, ,,
1935	Elgar, Ronald	,, ,,
1936	Evans, Mrs. S. F.	1 Balcombe Court, Balcombe Road, Branksome Park
1927	Exon, C., M.A.	12 Douglas Road, Southbourne

F

1919	Farmar, Mrs. K. A.	Whitton Lodge, Stevenson Crescent, Parkstone
1922	Farmar, Miss E. A.	,, ,, ,, ,,
1940	Ferguson, Mrs. E.	Burlesdon, Gervis Road East
1927	Finlinson, F. J.	Daneshill, 85 Queen's Park Avenue
1934	Finnis, Miss F. M.	Riversdale, Poole Road, Wimborne
1941	Flint, Mrs. V. L.	Cottonwood, East Cliff
1939	Follett, Mrs. B.	Windward, Mayfield Avenue, Parkstone
1938	Ford, J. C.	Hill Rise, Stephen's Lane, Verwood
1937	Forrest, Miss C. D.	Hiproof, Benellen Road
1925	Fountain, E. D., L.R.C.P., M.R.C.S.	Vron, 30 Mansfield Road, Parkstone

G

1939	Gardner, G. B., F.R.G.S.	Southridge, Highcliffe, Christchurch
1934	Geake, W. E.	6 Hathaway Road, Southbourne
1934	Geake, Mrs.	,, ,,
1941	Gillespie, Miss H.	East Anglia Hotel, Poole Road
1927	Gorton, B., M.R.C.V.S	22 Arnewood Road, West Southbourne
1936	Green, J. F. N., B.A., V.P.G.S.	Gabriel Court Hotel, Stoke Gabriel, Devon
1936	Grieveson, Miss S.	24 Surrey Road
1940	Grimes, Miss E. R., M.R.S.T.	Avenue Cottage, Highcliffe, Christchurch
1917	Grindley, Miss E. J.	67 Princess Road
1941	Gwyther, W. T.	12 Foxholes Road, Southbourne

H

1931	Haines, Mrs. E. M.	Appleslade, Ringwood
1929	LHaines, G. E.	602 Christchurch Road
1930	Haines, H. H., C.I.E., F.L.S.	Glyn Cogan, Berriew, Mont.
1931	Haines, Miss E. S.	,, ,,
1924	Hall, L. Beeching, F.L.S.	Bryn Aird, Blake Hill Crescent, Parkstone
1937	Hall, Mrs.	,, ,, ,,
1933	Harding, H. F.	Heather Glen, Western Road, Branksome Park
1934	Harding, Mrs.	,, ,, ,,
1934	Harding, Miss G. J.	,, ,, ,,
1940	Hardy, G. G.	21 Cassel Avenue, Westbourne
1912	Harrison, Henry	Beck Cottage, Grinton, Yorks
1941	Hart-Smith, J., A.R.C.S., F.I.C.	75 Southbourne Overcliff Drive
1940	Harvey, W. G.	3 The Triangle
1932	*Hatton, Mrs.	Dutch House, Cliff Road, Barton-on-Sea
1920	Hawes, Miss	The Moorings, 27 Nelson Road
1917	Haydon, C. J.	Greencroft, Cartmel, Grange-on-Sands, Lancs.
1909	Hayes-Barratt, J.	16a St. Augustine's Road
1941	Hayes-Barratt, Miss	,, ,,
1940	Heasman, Miss	Worth Cottage, St. Clair Road, Canford Cliffs
1941	Heasman, Mrs. E. A.	18 Sea Road, Boscombe
1941	Heathcote, W. H.	5 Keswick Road, Boscombe
1932	Hemmy, A. S., B.A., M.SC.	Anarkali, 45 Elgin Road
1917	Henderson, Miss A. J.	Springbank, 22 Fox Street, Greenock
1928	Henderson, Major H. E.	Tall Trees, 21 Wayside Road, Southbourne
1928	Henderson, R. G., M.A., M.B., CH.B. (Aber.), F.R.C.S. (Edin.)	87a Southbourne Road
1932	Henderson, Mrs.	,, ,,
1931	Herklots, Mrs.	Woodcroft Tower Hotel, Gervis Road
1941	Higgie, J. H.	10 Argyll Road, Boscombe
1923	Hill, C. S.	Northfield, Chigwell Road
1929	Hooper, Miss M. N.	Southland, Corfe Castle
1936	Hunkin, Miss K. A., B.A.	25 Foxholes Road, Southbourne
1932	Hunt, Mrs. P.	Cone Cottage, 33 Twynham Road, Southbourne
1930	Hurt, Miss C. E. C. J.	Flat 31, Ingleby, 6 Wimborne Road
1941	Hyndman, Miss M. A.	86 Overcliff Drive, Southbourne

I

1925	LInsch, J. M.	18 Beechwood Avenue, Boscombe

J

1940	Jackson, Miss E. M., B.A.	Kilmory, York Road, Broadstone
1933	James, Mrs. M. G.	70 St. Alban's Avenue

1930	Jefferys, J. H.	Elpis, 43 Caledon Road, Parkstone
1936	Jervois, Mrs. E.	27 Cecil Road
1933	Johnson, Miss A. C.	Rivelin, 25 Avenue Road, Christchurch
1930	Jones, Miss A. Parnell	Menstone, Frankland Crescent, Parkstone
1930	Jones, Mrs. W.	1 Park Road
1941	Jowitt, Mrs. H.	Hotel Mont-Fleuri
1930	Jubb, Miss O.	12 Oban Road

K

1937	Keay, D. D.	4 Berkeley Road, Winton
1930†*	Keeble, Sir F. W., K.B.E., D.SC., F.R.S.	
1940	Kempe, A. M., L.D.S., R.C.S.	71 Richmond Park Avenue
1929	Kendall, Mrs.	20 Serpentine Road, Poole
1928	Kendall, Miss G. J., A.R.C.M.	,, ,, ,,
1939	Kentish, Mrs. E. G.	1 Buckingham House, Courtlands, Maidenhead, Berks.
1935	Keutgen, E.	27 Knyveton Road
1937	Kidd, D. J.	33 Bath Hill Court
1927	Kilburn, Miss Alice M.	9 Glenmoor Road, Winton
1936	King, Mrs. A.	37 Linwood Road
1939	King, F. H.	Rexdene, Western Road, Branksome Park

L

1933	Leach, W. J.	43 Browning Avenue, Boscombe
1940	Lindup, Mrs. O. L.	Shalimar, Leven Avenue
1940	Lindup, Miss J.	,, ,,
1923	Littlewood, Eng.-Capt. A. W., R.N., O.B.E., Chevalier Legion of Honour.	28 Princess Road
1928	Longbottom, Mrs.	Haslemere, Penrith Road, Boscombe
1939	Lowde, Miss E., B.A.	Kilmory, York Road, Broadstone
1932	Lowther, F. L., B.A.	Lonsdale, Mayfield Avenue, Parkstone
1934 A	Lowther, Miss D. M., B.SC.	,, ,, ,,
1903*o	Lupton, Miss	The Cottage, St. Johns Road, Sandown, I.W.
1910	Lyon, Mrs. C.	Shalimar, Wilderton Road, Branksome Park

M

1908	Mackay, Miss	8 King's Park Road
1929	Mackay, Miss C. J.	,, ,,
1937	McArthur, Mrs. H. A.	Ravenscroft, Queen's Park Avenue
1909	McBean, Miss S.	74 Seafield Road, Southbourne
1932	McDougall, M., M.B., B.S.	8 Dunkeld Road
1932	McDougall, Mrs.	,,
1935	McMichael, E.	1 Branksome Wood Mansions, Branksome Wood Road

1940	Making, M.	61 Howard Road
1930†*	Malmesbury, The Rt. Hon. the Earl of, D.L., J.P.	Heron Court, Christchurch
1931	Marsh, W. H., B.SC.	Archways, 11 Mount Pleasant Lane, Ringwood
1936	aMarsh, Miss M. F., B.SC.	,, ,, ,,
1941	Mate, Mrs. F. M.	Windrush, 8 Clifton Road, Parkstone
1921	Mate, Mrs. S. J.	10, Landseer Road
1929	Meyrick, Sir George, BART.	Hinton Admiral, Christchurch
1939	Middle, Miss A. M.	Tregenna, Castle Lane
1930	Miller, Dr. A. H.	Branksea Tower, Osborne Road, Parkstone
1937	Milne, R. M.	Radegund, Pennington, Lymington
1934	Mitchell, Miss E. A.	109 Edgehill Road
1929	Mott, Lady	4 Dingle Road, Boscombe
1941	aMott, Miss J. C.	5 Wellington Road, Parkstone
1940	Mountfort, C. C., M.A.	Woodside, Pinewood Road, Ferndown
1940	Mountfort, Mrs. A.	,, ,, ,,
1941	Moxley, A. G.	33 Branksome Dene Road
1932	Mullins, Miss D. E. A.	Rosemaryne, 111 Edgehill Road
1936	Murdoch, Miss J. C.	3 Rotherfield Road
1935	Muspratt, C. K., B.A., F.R.G.S.	25 East Avenue
1935	Muspratt, Mrs.	,,

N

1941	Newmarch, Rev. E. W., B.A.	45 Wentworth Avenue, Boscombe
1939	Newsome, S. H.	86 Belle Vue Road, Southbourne
1939	Newsome, Mrs.	,, ,,
1938	Nix, Miss M. M.	66 Strouden Avenue

O

1929	Ogden, Miss E.	Southland, Corfe Castle
1910	lOke, A. W., B.A., LL.M., F.G.S., F.S.A.	32 Denmark Villas, Hove
1922	Ousby-Trew, Miss	Overthorpe, Michelgrove Road, Boscombe
1929	Owen, Mrs.	59 Manor Road
1929	Owen, J. D.	Barnweill, 42 Strouden Avenue
1929	Owen, Miss M. D.	,, ,,

P

1941	Pargeter, A. R., M.A.	Longmead, Meadow Road, New Milton
1928	Parry, Miss A. K.	Tilneyhirne, 10, St. John's Road, Boscombe
1934	Parsons, A. J., M.R.S.T.	Parva, 32 Morrison Avenue, Westbourne
1936	Parsons, Mrs. A. C.	,, ,, ,,
1939	Parsons, Miss D. M.	Maifoni, Brokes Road, Reigate
1938	Parsons, Miss S.	Bingley Moors, Queen's Park
1941	Paterson, P. J.	Durley Hall Hotel.

1924	Pattinson, Mrs.	35 Bath Hill Court
1916	Penrose, Mrs.	Woodbury, 11 Grove Road
1916	Penrose, Miss F.	,, ,,
1916	Penrose, Miss M., B.SC.	,, ,,
1929	Phelps, Mrs. J. V.	Woodbury, East Avenue
1934	Pickup, E. A.	24 East Avenue
1935	Pinder, T.	Dunster, Howard Road
1921	Pontifex, R. D., M.A.	Dalton House, 68 Christchurch Road
1939	Pope, Miss R. E.	The Oaks, Winsford, Minehead
1941	Popham, Miss C. H.	Grey Friars, Mudeford, Christchurch
1926	Potter, Rev. Prof. M. C., M.A., D.SC.	Corley Croft, York Avenue, New Milton
1930†*	Prain, Lt.-Col. Sir David, C.M.G., C.I.E., F.R.S.	The Well Farm, Warlingham, Surrey
1940	Priestley, A.	Pine Grange, Bath Road
1940	Pushman, J. C.	Worth Matravers, Swanage

Q

1924	Quick, Mrs.	Tregenna, Castle Lane

R

1927	Raine, A. D.	Milverton, Lymington
1927	Raine, Mrs.	,, ,,
1941	Ramsay, Mrs. F. M.	Whitecote, Newton Road, Canford Cliffs
1912	*Rankin, W. Munn, M.SC. (Leeds), B.SC. (Lond.) Hon. Member 1920	Hawthorne Cottage, Whitchurch Canonicorum, Bridport
1918	Ratcliffe, Mrs.	Brooklands, 32 Branksome Wood Road
1940	Ray, Mrs. B. M.	29 Penrith Road, Boscombe
1905	*Rayner, J. F., M.B. MYC. S.	Arlesey, Westerham, Kent
1935	Reid, A. H. G.	The Lawn, Forest Edge, Crow Hill, Ringwood
1932	Reid, Mrs. F. E. A.	,, ,, ,,
1924	*Reid, Mrs. E. M., B.SC., F.L.S.	Pinewood, Milford-on-Sea
1928	Richards, Mrs. E. M.	Flat 51, Hampshire Court
1931	Richardson, Miss I. M.	87 Cranleigh Road
1936	Ringrose, B. J.	Farley, Harbridge, Ringwood
1936	Ringrose, Mrs.	,, ,, ,,
1926	Rix, Miss M. E de B.	Wayside, Stourcliffe Avenue
1916	Roberts, H. Astley, B.A.	Shalvah, 18 Wilfred Road, Boscombe
1938	Roberts, E.	33 Brackendale Road
1941	Roberts, Mrs. W.	Overthorpe, Michelgrove Road, Boscombe
1924	†Robertson, W. G. A., M.D., D.SC., F.R.C.P., F.R.S. (Edin.), F.S.A. (Scot.)	St. Margaret's, St. Valerie Road
1934	Robertson, Mrs. M. K. A., M.D., L.R.C.P., F.R.S.G.S.	,, ,,
1939	Robins, E. A., F.R.P.S., F.L.S., F.R.M.S.	Fairway, Stanley Road, Waterford, Lymington
1929	Robinson, Miss M. H.	Byways, Chaddesley Glen, Canford Cliffs
1929	Robinson, Miss W. A.	,, ,, ,,
1923	Roden, Miss E. M.	12 Walpole Road, Boscombe
1938	Roden, Miss J. E.	,, ,, ,,
1936	Rooth, Mrs. A. V.	Farm Cottage, Canford, Wimborne

1940	Rose, P. T.	Glendemere, Barton Court Avenue, Barton-on-Sea
1933	Ross, Mrs. H. G.	Dingwall, Priory View Road, Moordown
1916	Rothwell, Mrs.	6 Mount Heatherbank, Richmond Gardens
1941	Rule, Capt. W. L.	St. Louis, Frankland Crescent, Parkstone
1935	Rush, Major J. S.	29 Lansdowne Road
1935	Rush, Miss C. J.	,, ,,
1941	Russell, Mrs. O. H.	Gorsemoor, Mayfield Avenue, Parkstone

S

1941	Sanford, Mrs. M. A.	25 Nelson Road, Bournemouth West
1938	Saville, W. B.	22 North Street, Guildford
1931	Scudamore, C. E., B.A., L.R.C.P.	24 Hampshire Court
1941	Sexton, Miss F.	60 Uplands Road
1919	Sharp, Miss E.	Langdon, Parkstone
1941	Sharp, Miss S. D.	,, ,,
1933	Sheffield, Miss I. E.	177 Richmond Park Road
1937	Sherwood, Miss H.	264 Charminster Road
1938	Shirreff, Miss M.	Forest Park Hotel, Brockenhurst
1932	Silvester, N. L., M.SC., F.A.MET.S.	East Cliff Hall
1937	Simmons, W. C., B.SC., A.R.C.S., F.G.S.	7 Clifton Road, Parkstone
1937	Simmons, Mrs. I. M.	,, ,, ,,
1920	Simpson, N. Douglas, M.A., F.L.S., F.R.M.S.	Maesbury, 3 Cavendish Road
1914	Smyth, W. Johnson, M.D.	Killalief, 534 Holdenhurst Road
1915	Smythe, Mrs.	37a Cavendish Road
1920	Smythe, Miss D.	,, ,,
1916	Smythe, Miss K. M.	,, ,,
1940	Somerville, Mrs. S.	Rumah Kechil, Pinewood Road, Ferndown
1932	Spence, W. G.	The Shieling, Highlands Road, Barton-on-Sea
1932	Spence, Miss J. G.	,, ,, ,,
1941	Spencer, Mrs. I.	Athelney, Westminster Road
1909	Spencer, J. F.	Glenthorne, 73 Richmond Park Road
1923	Stables, A. D.	Saxthorpe, St. Osmund's Road, Parkstone
1923	Stables, Mrs.	,, ,, ,, ,,
1923	Starr, Col. W. H., C.B., C.M.G., C.B.E.	4 Foxholes Road, Southbourne
1916	Stiff, S. J., B.SC.	Norden House, Corfe Castle
1916	Stiff, Mrs.	,, ,,
1916	Stiff, Miss M. J.	,, ,,
1924 A	Story, F. N.	Storyland, Church Road, Southbourne

T

1940	Taylor, E. O., B.A., B.SC.	3 Hadden Road
1940	Taylor, Mrs. E. E.	,,
1937	Terrell, G. H.	53 Wentworth Avenue, Boscombe
1925 A	Thomasson, Miss M. E.	37 Belvedere Road
1936	Trayfoot, Mrs. L. W.	25 Eaton Road, Branksome Park
1914	Twemlow, Miss E. E.	Devon Lodge, 83 Alumhurst Road

V

1918	Vorse, John	Leighurst, Walkford, Christchurch

W

1924	Wadlow, H. J.	The Gables, Queen's Grove, Parkstone
1921	Wales, Miss	The Nook, 4 Ormonde Road, Branksome Park
1921	Wales, Miss N.	,, ,, ,,
1940	Walker, Howard	14, Grand Avenue, West Southbourne
1913	Wallace, W. G.	61 East Avenue
1937	Walters, Miss E.	Uplands, Rowlands Hill, Wimborne
1936	Waltham, E. Ernest	c/o National Provincial Bank, Christchurch Road, Boscombe
1920	L Wanstall, W. S.	Del Monte, 6 Roslin Road
1920	L Wanstall, Mrs.	,, ,,
1936	Warlow, Frank, L.D.S.	99 Southbourne Road
1941	Waters, Miss M. E., B.SC.	Redroof, Milford-on-Sea
1936	Watkin, Ralph	Avila, Spur Hill Avenue, Parkstone
1941	Watson, Miss G. V.	35 Knyveton Road
1941	Watt, Mrs. W. Boyd, M.B.O.U., F.Z.S.	12 Campbell Road, Boscombe
1930	Webb, Mrs. F. J.	Melbury, 18 Soberton Road
1936	Weekes, Mrs. M.	3 Rotherfield Road
1940	West, Mrs. F. M.	c/o Lloyd's Bank, 28 Fleet Street, London, E.C.4.
1913	Wetherell, Miss M.	Triana, 31 Harvey Road, Boscombe
1920	Wetherell, Miss S.	,, ,, ,,
1918	Whitaker, S.	22 Somerset Road, Boscombe
1924	Whitaker, Miss E. M.	,, ,, ,,
1924	Whitaker, S. E., P.A.S.I.	22 Selwood Road, Addiscombe, Croydon
1931	A White, S. J.	7 Gilbert Road
1929	Whiteley, F. W.	The Fells, West Lulworth, Dorset
1939	Williams, C., O.B.E., M.A.	The Close, Ringwood
1940	Wimpress, J. P.	4 Glenroyd Gardens, Southbourne
1903	O Woodhouse, W. J., A.C.P., M.I.H.	29 Twynham Road, Southbourne
1918	Woodhouse, Mrs.	,, ,, ,,
1923	Woodhouse, W. R.	,, ,, ,,
1923	Woodhouse, Miss M. M.	,, ,, ,,
1931	Woods, J. C.	Pine Croft, Rothesay Road
1931	Woods, Mrs.	,, ,,
1930	†*Woodward, Sir A. Smith, F.R.S., F.L.S., F.G.S.	Hill Place, Haywards Heath, Sussex
1932	Wren, G. G.	264 Charminster Road

Y

1935	Young, Rev. A. W.	542 Holdenhurst Road

Annual Meeting, 1941.

The Thirty-eighth Annual Meeting of the Bournemouth Natural Science Society was held at 3 p.m. on Saturday, the 25th October, 1941, under the chairmanship of Mr. Henry Bury, Chairman of Council.

The minutes of the Annual Meeting of 1940 were read by the Hon. Secretary, Mr. W. J. Woodhouse, and were signed by the Chairman, after having been approved.

The reading by the Hon. Secretary of the Council's Report for the year ending 30th September, 1941, was followed by the Hon. Treasurer's presentation and explanation of his Statement of Accounts for the year, and both the Report and the Accounts were adopted unanimously, on the proposal of Dr. Edwards, seconded by Major J. S. Rush.

Mr. Beeching Hall moved the vote of thanks to the retiring President, the Revd. Prof. M. C. Potter, M.A., D.Sc., paying special tribute to the assistance given by Dr. Potter to the field work of the Society during the year. These sentiments were endorsed by Mr. F. L. Lowther in seconding the proposal, which was passed by acclamation.

The announcement of the President for 1941-42, Instr.-Capt. M. A. Ainslie, R.N., B.A., F.R.A.S., was made by the Chairman, whose comments on Captain Ainslie's wide reputation and attainments as an astronomer were warmly applauded by the meeting.

The election of Officers for 1941-42, which followed, was proposed by Dr. Scudamore, who expressed his appreciation of the work done by the Officers. This was seconded by Mrs. W. Boyd Watt, and the motion was carried unanimously. The Chairmen of Sections were elected on the proposal of Mr. T. E. Waltham, seconded by Mr. Wren. The Microscopical Chair, resigned by Mr. E. A. Robins, was not filled.

As the result of a ballot vote, the following members were elected to the Council for a period of two years:—Mr. F. Broad, Mr. H. de Castro, Mr. B. Gorton, Dr. M. C. Potter, Mr. G. G. Wren.

The Hon. Auditors, Messrs. F. Broad and J. C. Woods, having kindly consented to serve again, their election was proposed by Mr. Parsons, and seconded by Miss Parnell Jones. A vote of thanks to the Hon. Auditors was moved by Mr. Whitaker, seconded by Dr. Cameron, and carried unanimously.

The meeting closed with the enthusiastic approval of a vote of thanks to the Chairman, proposed by Dr. Cameron in a short and appreciative speech, and seconded by Miss Twemlow.

Council's Report, 1941.

THE Council has to announce a further decline in the membership of the Society from 404 to 376. Although 42 new members were elected during the year, the loss from death and resignation has been 61, and nine members were struck of for non-payment of subscriptions. Two members have paid life subscriptions, bringing the total of life members up to eight; there are 14 honorary members, 4 original, 10 past presidents and 10 associate members.

Some, at least of the members resigning, have signified their intention of rejoining the Society after the war. In such cases, it would materially assist the Society in its struggle against present financial difficulties, if members leaving the town for the duration of the war would, instead of resigning, continue to pay a subscription of 10s. annually as country members; this would also make their re-election later unnecessary. The Council would like particularly to request members leaving Bournemouth to send in their resignation or change of address before they leave the town, and, in accordance with Rule 10, to pay their subscriptions up to date. Not only will this make easier the work of the Hon. Treasurer and Secretary, but it will also save the Society unnecessary expense in stationery and stamps.

The deaths of Mr. Heywood Sumner in December, 1940, of Mr. J. R. White in January, 1941, and of Mr. P. M. Bright in February, 1941, have been a heavy blow to the Society. Mr. Heywood Sumner, a Morris Gold Medallist and a Fellow of the Society of Arts, joined the Society in 1918, and was President for the two years 1926-28. Mr. J. R. White, M.A., became a member of the Society in 1920, and held the office of Honorary Editor from 1925 until his death. He was one of the best known and most popular figures in the Society, and the Council is indebted to him for his efficient editing of the yearly Volume of the Society's Proceedings. The tragic death of Mr. P. M. Bright, J.P., removed from the Society one of its keenest entomologists. He was elected to the Society in 1931, and was Chairman of the Entomological Section from 1933-34.

The other deaths which the Council has regretfully to record are those of Dr. McLachlan Banks, Mrs. F. Broad, Colonel Dundee, Miss Farmer, Mr. G. F. Harding, R.A.F. (who died on active service, and is buried in Germany), Mr. Hatcher, Mr. W. Love, Miss Moss, Mr. C. Sharp, and Mrs. Thomson.

There has been only one change among the Officers of the Society during the past year. Miss M. Penrose has honoured the Society by accepting the office of Honorary Editor left vacant by the death of Mr. J. R. White. The Council has, however, to report the resignations of two officers whose successors have not yet been elected. It will be a matter of regret to all the members of the Society to hear that our able and popular Honorary Treasurer, Mr. A. J. Parsons, has felt obliged to resign the position which he has filled with conspicuous ability since 1938. Mr. Parsons has been kind enough to agree to carry on his work until the Council has appointed his successor, but up to the present, no nominations to the office have been received. Mr. E. A. Robins, Chairman of the Microscopical Section, has, to the Council's deep regret, resigned his chairmanship, owing to pressure of war work, and no chairman has, so far, been elected in his place.

Last winter, the Society held 79 meetings in addition to the Annual General Meeting and the Presidential Address. 15 General and 64 Sectional lectures and meetings were held.

The scope of the summer excursions was limited by transport difficulties, and those held were to places in the immediate neighbourhood. There were no General Excursions, but Sectional numbered 33.

The Presidential Address was given on Saturday, November 2nd, 1940. The President, the Revd. Prof. M. C. Potter, addressed the Society on the subject of " Plants as Food."

In November and December, lectures began at 2.30 p.m., instead of at the usual time of 3 p.m., and the same practice will be adopted this year.

The use of various parts of the Society's premises by the A.R.P. and the Central Hospital Supply Service has continued throughout the year. An invitation has been given by the Council to members of H.M. Forces to attend lectures without charge. So far, no one has availed himself of this invitation.

The Tea Committee, under the Chairmanship of Miss Roden, struggled valiantly for some time against ever-increasing difficulties. Finally, however, it became impossible to procure food in sufficient quantity to continue the teas, and a new arrangement had to be made. By this, members are provided with hot water and attendance at a charge of 2d., but are required to bring their own tea, milk and food.

The Council again asks members of the Society to give it their whole-hearted support during the coming year, as they have done in the past. The future is not very bright; the expenses of the Society through taxation and war insurance have greatly increased, while membership has declined. New members are urgently needed, and the Council looks to present members to do all they can to introduce new members to the Society and so to assist in increasing the annual revenue.

In conclusion, the Council wishes to thank all those who have presented gifts to the Society during the past year, and those who, by distributing the volumes of the Proceedings, by operating the lantern, by giving lectures, or by leading excursions have provided the Society with invaluable assistance in the furtherance of its aims in the advancement of Science.

Summary of the Accounts for the Year ending 30th September, 1941.

CURRENT ACCOUNT.

Receipts.

	£	s.	d.	£	s.	d.
Annual Subscriptions				301	10	0
Arrears for 1939-1940				3	0	0
Monthly Visitors				0	17	6
Donations:—						
Special for Payment of Assistant Secretary	35	0	0			
For National Trust	1	8	6			
Anonymous	1	0	0			
Various Members	0	5	6			
				37	14	0
Rent from Tenants				135	0	0
A.R.P. Occupation Compensation				8	0	0
Hire of Hall				2	0	0
Gas				14	4	3
Electricity				0	7	10
Pence for use of Telephone ...				1	12	6
Sales of Proceedings				2	18	6
Hire of Lantern Slides				0	2	6
				507	7	1

Payments.

	£	s.	d.	£	s.	d.
Interest on Debentures	151	13	0			
Less Tax	70	3	3			
				81	9	9
Income Tax, Schedule D ...				0	8	6
Ccrporation Duty				3	9	10
House Maintenance:—						
War Damage Contribution ...	20	10	0			
Property Tax	87	2	6			
Rates	83	14	2			
Water	3	0	10			
Gas	29	3	11			
Electricity	6	3	9			
Coal and Coke	46	10	0			
Wages	76	12	4			
Insurances	20	1	9			
Telephone	9	11	8			
Furnishing and Upkeep ...	10	6	8			
				392	17	7
Garden Maintenance:—						
Wages	21	3	9			
Other Expenses	0	2	9			
				21	6	6
Secretarial Expenses:—						
Printing and Stationery ...	19	1	4			
Postage	15	7	5			
Cheque and Receipt Stamps ...	1	1	6			
Assistant Secretary	43	9	4			
				78	19	7

	£	s.	d.		£	s.	d.
				Volume XXXII. Proceedings of the Society	21	8	11
				War Insurance of Library ...	4	10	0
				Other Expenses of Library ...	1	11	0
				Subscriptions to other Societies ...	2	16	0
				Carriage of Slides	0	4	0
					609	1	8
Balance from 1940	170	19	8	Balance	69	5	1
	£678	6	9		£678	6	9

DEPOSIT ACCOUNTS.

Debenture Fund.	£	s.	d.		£	s.	d.
Balance brought forward	40	14	7	Balance on Deposit	41	4	6
Interest to 31st December, 1940	0	9	11				
	£41	4	6		£41	4	6

Building Fund.	£	s.	d.		£	s.	d.
Balance brought forward	52	14	5	Balance on Deposit	53	7	2
Interest to 31st December, 1940	0	12	9				
	£53	7	2		£53	7	2

Archæological Research Fund.	£	s.	d.		£	s.	d.
Balance brought forward	9	19	9	Balance on Deposit	10	1	8
Interest to 31st December, 1940	0	1	11				
	£10	1	8		£10	1	8

Redemption Fund.

	£	s.	d.		£	s.	d.
Balance brought forward	30	2	8	Debenture No. 12 redeemed	50	0	0
Interest to 31st December, 1940	0	6	0	Balance on Deposit ...			
Life Subscription—Jas Insch	10	0	0				
Life Subscription—Mrs. Bigg	10	0	0				
Sales of Photographs	0	8	9				
	£50	17	5				

Note.—With gratitude it is recorded that the balance carried forward in the Current Account again includes a sum of £35 given by a generous friend towards the payment of an Assistant Secretary during the coming year.

A. J. PARSONS,
Honorary Treasurer.
September, 30th, 1941.

We have examined the above accounts with the books of the Society, and the vouchers for payments, and certify the same to be correct.

FREDERIC BROAD } Hon.
JOHN C. WOODS } Auditors.

Bournemouth, 10th October, 1941.

FORM OF LEGACY.

The following Form of Bequest is recommended for adoption by those who may be desirous of leaving by Will money for promoting the objects and work of the Society :—

I give absolutely to the Treasurer for the time being of the Bournemouth Natural Science Society of No. 39 Christchurch Road, Bournemouth, for the general purposes of the Society the sum of £ s. d. free of duty, and I declare that the receipt of the said Treasurer for the time being shall be sufficient discharge for the said legacy.

Summary of Meetings and Excursions.

N.B.—A detailed report is omitted this year, but one will be placed on view in the Library at 39 Christchurch Road.

General.—Seven Meetings and twelve Club-days.

Archæological and Historical Section.—Seven Meetings and six Excursions.

Astronomical Section.—Two Meetings.

Botanical Section.—One Meeting and eighteen Excursions.

Entomological Section.—Five Meetings.

Geographical Section.—Four Meetings.

Geological Section.—Two Meetings and three Excursions.

Microscopical Section.—Eight Meetings.

Photographic Section.—Six Meetings.

Physical Section.—Three Meetings.

Zoological and Biological Section.—Twenty-five Meetings.

Combined Sectional Meetings and Excursions.—Geological and Biological Sections, one Meeting. Astronomical and Physical Sections, one Meeting. Botanical and Entomological Sections, four Excursions.

Library Report.

The following members have presented books or magazines to the Library:—Mr. H. Bury, Mrs. Claude Lyon, Mr. W. C. Simmons, Miss Mersen, Miss Banham, Miss Male, Mr. J. F. Green, Mrs. and Miss Penrose and the Executors of the late Mr. J. R. White.

The Society is also indebted to Mrs. Quick for a gift of lantern-slides.

The death of Mr. J. R. White is a great loss to the Library as he was Chairman of Committee from 1937 until his death.

Museum Report.

The thanks of the Society are due to the following for gifts to the Museum:—

Mr. V. J. Adams for cases of stuffed birds and nests, as well as archæological and geological specimens.

Dr. H. C. Male for a cabinet of fossils including a notable collection of bones from Clevedon Cave.

Report of the Zoological Section

Observations on Birds in the Bournemouth District from October 1st 1940, to October 1st, 1941.

BY F. L. LOWTHER, B.A.

Notes on this subject should be sent in future to Miss C. Popham, Grey Friars, Mudeford.

We regret that it has been found necessary to omit the usual notes on the arrival of migrants on account of lack of space. The present report is confined to occurrences which have taken place within a radius of about 12 miles from Bournemouth, including Poole and Christchurch Harbours, the east coast of the Isle of Purbeck to St. Aldhelm's Head, and the western part of the New Forest. Those relating to Dorset are marked [D].

Raven, *Corvus c. corax*. Several, including young, Stanpit Marsh, Jan. and April (CP). One at Ower, April 28th (EB) [D].

Hooded Crow, *Corvus c. cornix*. One, Stanpit Marsh, Oct. 25th (CP).

Lesser Redpoll, *Carduelis flammea cabaret*. Near Winkton, Jan. 6th (CP).

Siskin, *Carduelis spinus*. Male, Mudeford, Feb. 27th (CP).

Crossbill, *Loxia c. curvirostra*. East Cliff, June 10th (MP). Bournemouth, Sept. 26th (JES).

Cirl Bunting, *Emberiza c. cirlus*. Blake Hill, May 9th (LBH). [D].

Wood-Lark, *Lullula a. arborca*. Five at Mudeford, Oct. 9th (CP).

Red-backed Shrike, *Lanius c. collurio*. Feeding four young, Parley, June 17th (JF). Pair seen again with young, June 27th (JF., VF., MJ., WBW). [D].

Grasshopper Warbler, *Locustella n. nœvia*. Ower, May 3rd (EB). [D].

Marsh Warbler, *Acrocephalus palustris*. Mudeford, May 29th (CP).

Dartford Warbler, *Sylvia undata dartfordiensis*. Studland, Sept. 8th (JF., VF). [D].

Whinchat, *Saxicola rubetra*. Stanpit Marsh, Aug. 22nd (WBW). Mudeford, Sept. 18th (CP).

Black Redstart, *Phœnicurus ochrurus gibraltariensis*. Southbourne, Mar. 13th (CP).

Nightjar, *Caprimulgus e. europæus.* One pair, Mudeford (CP). Heard from Parkstone Golf Links, June 8th (JF., VF). Parkstone, July 2nd (L). [D].

Wryneck, *Jynx t. torquilla.* Parkstone, April 24th (L). [D]. Stanpit Marsh, May 1st (CP).

Short-eared Owl, *Asio f. flammeus.* Mudeford, Jan. 24th (CP).
Buzzard, *Buteo b. buteo,* Holmsley, Mar. 6th. Also near Mudeford, Feb. 3rd, Sept. 25th and 26th (CP).

Montagu's Harrier, *Circus pygargus.* Near Thorney Hill, New Forest, July 8th (CP).

Sparrow-Hawk, *Accipiter n. nisus.* Lower Parkstone, Jan. 5th (JF., VF). Ower, April 7th (EB). [D].

Spoonbill, *Platalea l. leucorodia.* Stanpit Marsh, Oct. 20th to end of December (CP).

Bittern, *Botaurus s. stellaris.* One injured, Mudeford, Mar. 2nd (CP).

Flamingo, *Phœnicopterus ruber roseus.* Stanpit Marsh, July 7th (CP).

Grey Lag-Goose, *Anser a. anser.* Nine flying S.W. over Christchurch Harbour, Dec. 20th (CP).

White-fronted Goose, *Anser a. albifrons.* One, Christchurch Harbour during cold spell in January (CP).

Pink-footed Goose, *Anser fabalis brachyrhynchus.* One Christchurch Harbour, Jan. (CP).

Dark-breasted Brent Goose, *Branta b. bernicla.* About fifty in Christchurch Harbour, April 1st (CP).

Canada Goose, *Branta c. canadensis.* Stanpit Marsh, June 30th (CP).

Sheld-Duck, *Tadorna tadorna.* Nesting, Ower, April 29th (EB). [D]. With young, Mudeford, June 6th (CP).

Mallard, *Anas p. platyrhyncha.* Large numbers in Jan. during cold spell in Christchurch Harbour and up Avon Valley (CP).

Gadwall, *Anas strepera.* Five in Christchurch Harbour, Jan. 19th (CP).

Teal, *Anas c. crecca.* Christchurch Harbour, Jan. (CP). Ower, Mar. 21st (EB).

Garganey, *Anas querquedula.* Eleven in Christchurch Harbour, Mar. 22nd (CP).

Wigeon, *Anas penelope.* Christchurch Harbour, Jan. (CP).

Shoveler, *Spatula clypeata.* Christchurch Harbour, Jan. (CP).

Tufted Duck, *Aythya ferina*. Christchurch Harbour, Jan. (CP).

Scoter, *Melanitta n. nigra*. Christchurch Harbour, Jan. (CP).

Cormorant, *Phalacrocorax c. carbo*. With white patch, Stanpit Marsh, Jan. 17th (CP).

Great Crested Grebe, *Podiceps c. cristatus*. Stanpit Marsh, off shore, Nov. 18th, 20th, Dec. 26th (CP).

Little Grebe, *Podiceps r. ruficollis*. With young, Spettisbury, July 22nd (WBW). [D].

Red-throated Diver, *Colymbus stellatus*. Two dead (oiled), Avon beach, Jan. 16th. Five, River Stour, Jan. 22nd. Three, Christchurch Harbour, Mar. 19th; one Dec. 15th (CP).

Bar-tailed Godwit, *Limosa l. lapponica*. Stanpit Marsh, Oct. 20th, Dec. 22nd, Jan. 13th. Thirteen in Christchurch Harbour (three in summer plumage), May 10th (CP).

Whimbrel, *Numenius p. phœopus*. Mudeford, April 27th (CP).

Woodcock, *Scolopax rusticola*. Mudeford, Feb. 3rd (CP).

Knot, *Calidris c. canutus*. Christchurch Harbour, Jan. 6th (CP).

Dunlin, *Calidris alpina schinzii*. In summer plumage, Stanpit Marsh, April 14th (CP).

Sanderling, *Crocethia alba*. Mudeford, Oct. 25th (CP).

Ruff, *Philomachus pugnax*. Three, Stanpit Marsh, Aug. 25th (CP).

Wood-Sandpiper, *Tringa glareola*. Stanpit Marsh, Aug. 27th (CP).

Green Sandpiper, *Tringa ochropus*. Stanpit Marsh, Oct. 20th (CP).

Greenshank, *Tringa nebularia*. Mudeford, Sept. 29th (CP., WBW).

Ringed Plover, *Charadrius h. hiaticula*. No nests on Avon Beach (CP).

Golden Plover, *Pluvialis a. apricaria*. Two at Tuckton, Feb. 6th. One at Mudeford, Feb. 11th (CP).

Grey Plover, *Squatarola squatarola*. Four in summer plumage, Stanpit Marsh, May 18th. Several, Oct. 16th (CP).

Oyster-catcher, *Hœmatopus ostralegus occidentalis*. One pair, Christchurch Harbour, Dec. 15th (CP). Many, Poole Harbour (L).

Sandwich Tern, *Sterna s. sandvicensis*. Mudeford, May 8th (CP).

Common Tern, *Sterna h. hirundo*. Mudeford, April 17th and Sept. 26th (CP).

Little Tern, *Sterna a. albifrons.* Mudeford, April 28th and June 12th (CP., WBW).

Common Gull, *Larus c. canus.* Mudeford, July 20th and Aug. 6th (CP). Two at Studland, Sept. 18th (JF., VF). [D].

Lesser Black-backed Gull, *Larus fuscus graellsii.* Several, Mar. 17th and Sept. 22nd, Stanpit Marsh (CP).

Great Black-backed Gull, *Larus marinus.* Several, Mar. 17th and Sept. 22nd, Stanpit Marsh (CP).

Glaucous Gull, *Larus hyperboreus.* Near Lymington, May 24th ("B.B.," July, 1941, Page 39).

Kittiwake, *Rissa t. tridactyla.* More numerous than usual (CP).

Corn-Crake, *Crex crex.* Ower, May 8th (EB). [D].

Water-Rail, *Rallus a. aquaticus.* With young, Mudeford, May 25th (CP).

Red-legged Partridge, *Alectoris r. rufa.* Ower, April 2nd (EB). [D].

The following abbreviations are used :—EB=T. E. Belcher; JF = J. Follett; VF = Mrs. Follett; LBH = L. Beeching Hall; MJ=Mrs. James; L=F. L. Lowther; MP=Miss M. Penrose; CP=Miss C. Popham; JES=Miss Sheffield; WBW=Mrs. Boyd Watt; BB="British Birds" Magazine.

Report of the Entomological Section.

Lepidoptera.

Comma Butterfly. A good number reported from the area.

White Admiral. Several seen at Hampreston in the woods.

Clouded Yellow. A fair migration took place.

Large White. In normal numbers this year.

Lulworth Skipper. Seen at Corfe Castle.

Peacock. Getting scarce in the area.

Pine Hawk. In good numbers.

Leopard Moth. One brought to the Headquarters.

Hymenoptera.

A nest of the honey bee was found at Parley in a hole in an oak tree. The bees were smoked out and the honey-combs taken. Only four and a half pounds of honey were extracted.—S.C.S.B.

Note on the Occurrence, near Bournemouth, of a Spider of the Family Argiopidae, probably of Foreign Origin.

Mr. E. A. Robins, F.L.S., F.R.M.S., P-P.R.P.S., reports that Mrs. Marshall Bell has discovered a colony, near Bournemouth, of spiders of a species not hitherto recorded as British. It resembles very closely *Miranda Aurantia,* a species which occurs in North America.

Description.—The abdomen is striped yellow and black and the cephalo-thorax is covered with long silvery hairs, the legs are also striped in bands. The body averages from 15 mm. to 18 mm. in length.

The spider lives on grasshoppers, and the web, spun in loose grass near the ground, is of geometrical form with a zig-zag ladder of silk across the vertical diameter known as a *stablimentum.*

The cocoon is remarkable, being about 15 mm. to 18 mm. long, pear-shaped with an outer covering of a paper-like substance. The eggs are contained in an inner sac suspended from the neck of the cocoon; the space between the inner and outer cases being filled with loose reddish-brown silk.

The species was first observed by Mrs. Marshall Bell during the summer of 1940.

Presidential Address, 1941.

Life in Other Worlds

delivered Nov. 1st, 1941, by

INST.-CAPT. M. A. AINSLIE, R.N., B.A., F.R.A.S.

At intervals of rather more than two years our night skies are adorned by the presence of the bright planet Mars, making one of its periodical visits to the neighbourhood of the Earth, and shining, for a few weeks, with a lustre often rivalling that of Jupiter, and with a characteristic ruddy hue which everyone must have noticed. At such times all who are known to be interested in Astronomy, and especially those taking an active part in observation, are inundated with questions like, "Do you think there are men on Mars?" a question which, it need hardly be said, is very difficult to answer, in the complete absence of any definite evidence. At the same time such questions indicate a widespread belief in the possibility of life on other worlds, and, though there is a lot of "wishful thinking" about them, it is worth while to examine such evidence as we have. That is what I want to do this afternoon; to sum up as well as I can the main facts so far as they have been ascertained either by theory or by observation, from the Astronomical point of view; with the philosophical aspect of the matter I have nothing to do.

I suppose that I ought to start by defining what I mean by "life." But it is very hard to give a definition which would satisfy everybody, so I will leave you to give your own definition as you may think fit; though if each of us in this room were to write down his or her definition of "life," I doubt whether there would, after all, be much essential difference between our ideas.

Whatever view we take as to the nature of life, we must be struck by the dominating part played by the element Carbon. With hardly any exceptions, all living things are built up of extremely complicated compounds of carbon, together with various metals and other ingredients; but carbon is always present. It appears that of the 92 elements predicted by physico-chemical theory, all but two of which have actually been examined, carbon is the only one capable of forming the complicated compounds required; and this again postulates the presence of water in the liquid state; i.e., not ice or steam. So the range of temperature within which life can develop continuously is very limited. Whether Silicon, which, chemically speaking, is closely allied to carbon, can form the necessary compounds at higher temperatures is a question that must not be left out of account; all we can say from our experience is, that it does not seem to do so; we can probably, when dealing with life as we can observe it, say that we must have carbon, liquid water (and this also postulates water vapour), and, except in the case of some of the very lowest organisms, free oxygen.

We have, then, in our search for life, to look primarily for localities where the temperature is suitable, i.e,, between 0° and 100° on the Centigrade scale, and we shall find our choice very limited; the stars (of course including the sun, which is only a moderate sized star, neither very bright as stars go, nor very hot) are far too hot, the "coolest" of them having a surface temperature of at least 1800°C., and the hottest 36,000°, and very possibly more; we must look for suitable conditions to the planets of our solar system, or to those belonging to other similar systems, if indeed such exist.

And when we come to the planets of our solar system, we are still further limited; for we have to consider not only surface temperature, but also the question of atmosphere and moisture. Surface temperature depends almost entirely on the amount of light and heat received from the sun and re-radiated from a planet's surface; for the amount of heat reaching the surface of a planet by conduction or convection from its interior is negligible compared with that received from the sun.

Whether a planet has an atmosphere or not is decided by the gravitational attraction at its surface; the moon has insufficient attraction to retain an atmosphere, and the same may be said of Mercury and of the various satellites of the solar system, three of which (Titan (the 6th satellite of Saturn) and the 3rd and 4th satellites of Jupiter) are about as large as Mercury, the others being a good deal smaller. Moisture is largely a question of temperature and of a sufficient supply of water, which must be in the liquid state if it is to take part in vital processes.

The intensity of the sun's light and heat received by a planet depends on its distance from the sun, varying as the inverse square of this; so that if we take the intensity received by the earth as unity, then at their mean distances from the sun the other planets will receive as follows:—

Mercury,	6.7	times	as much	as the earth;
Venus,	1.9	,,	,,	,,
Mars,	0.43	,,	,,	,,
Jupiter,	0.037	,,	,,	,,
Saturn,	0.011	,,	,,	,,
Uranus,	0.0027	,,	,,	,,
Neptune,	0.0011	,,	,,	,,

and we see that the planets, in respect of solar radiation received, fall into three well-defined groups or "zones," of which what we might call the "torrid zone" is occupied by Mercury; the "temperate zone" by Venus, the Earth, and Mars; and the "frigid zone" by Jupiter, Saturn, Uranus and Neptune.

Mercury, as the abode of highly developed life, or, indeed, of any life at all, does not seem to offer any great possibilities; its atmosphere (if it has one at all, which is very improbable) can only be very scanty and attenuated; and observations of such surface markings as have been seen by a few observers indicate that it always turns the same face to the sun; from which it appears that the sunlit face must be at a temperature comparable with that of melting lead, and the dark hemisphere at a temperature not far removed from the absolute zero, 273°C. below the freezing point of water (i.e., −273°). Probably we can rule out Mercury as a likely abode for living things.

Passing now to our "frigid zone," we have an altogether different state of things to consider; from our table (above) we see that even Jupiter only receives, on each square mile of his surface, about 1/27 as much light and heat as we do from the Sun; and actual measurement of the heat we receive from Jupiter shows that his surface must be at a temperature of about 140°C. below the freezing point of water. The spectroscope indicates that his atmosphere is chiefly composed of Ammonia and Methane (marsh-gas); and when we pass to the planets still further removed from the sun, we find much the same conditions as prevail on Jupiter, except that the temperature is still lower, and the ammonia mostly frozen out.

Life at a temperature of −140°C in an atmosphere of ammonia and marsh-gas does not seem probable; and I think we can fairly rule out our planets of the "frigid zone" as most unlikely to be inhabited.

We are thus left, so far as our solar system is concerned, with Venus and Mars; and these demand more detailed consideration. Venus is hotter than the Earth, but not overwhelmingly so; Mars is colder, but comparable. We may consider Venus first.

Of all the planets of the solar system, Venus is the most difficult to observe; her intense lustre dazzles the eye, and accentuates both the imperfections of the telescope and the atmospheric disturbances which always, in a greater or less degree, interfere with sharp and steady vision. Venus never departs (in the sky) from the sun more than about 47°, and is best observed in daylight rather than on a dark sky; but even under the best conditions she never exhibits markings of a well-defined nature; such features as have been recorded are extremely faint, and generally doubtful at the best; though it is only fair to say that of recent years several capable observers have considered these features as permanent, and even named and mapped them. But in any case it appears quite certain that what we observe on Venus is the upper surface of an extremely dense cloud-layer, reflecting a very high proportion of the sun's light and heat, and appearing perfectly white to an observer outside it.

We do not know how far from the actual solid surface of the planet this cloud layer is; but that it is not the upper limit of the planet's atmosphere is known from two facts; (1) when Venus exhibits the crescent phase, the cusps are often seen extending beyond the semi-circle; and (2) on the rare occasions when Venus passes in front of the sun, she shows, when partly projected on the sun's disc, a complete arc of light round the part still projected on the sky. These effects are clearly due to refraction in an upper atmosphere—a sort of twilight in fact—and it is possible to deduce from them the existence of a tenuous layer of some gas or gases above the clouds, and even to estimate its density, which is found to be extremely low.

The composition of this upper atmosphere, as revealed by the spectroscope, is remarkable; there is a large quantity of Carbon dioxide present, but little or no oxygen or water vapour; and if the composition of the upper atmosphere may be taken as a fair sample of the lower regions (below the cloud layer), it seems as though the atmosphere of Venus must be heavily charged with carbon dioxide—which would be fatal to any form of animal life—and almost completely free from oxygen or water vapour; this looks as though plant life, the chief source of free oxygen in our terrestrial atmosphere, has as yet hardly made its appearance, while animal life is still in the distant future. Of course there may be, far below the cloud layer and on the actual surface of the planet, sheets of water like our oceans and seas, though of no great depth, and the ascending and descending currents caused over these by the sun's heat may be indicated by the very faint variations in the brightness of the cloud layer which are regarded by some observers as permanent surface features; but as nothing can be seen of the planet's actual surface, it is idle to speculate on this point.

The question of the temperature prevailing below the cloud layer is to a great extent connected with that of the planet's diurnal rotation. For a long time it was supposed that Venus, like Mercury, always turns the same face to the sun; but the fact that the dark side of the planet sends us a small, but measurable, amount of heat seems to show that this is not the case, for a surface in permanent darkness would sink to a temperature not far removed from the absolute zero. It can be shown by the spectroscope that the rotation cannot be anything like as rapid as that of our earth, and that a day, on Venus, lasts at least several of our weeks, and the temperatures of sunlit and dark hemispheres will have a tendency to equalisation; though owing to what might be called the "greenhouse effect" of the cloud layer, permitting the influx of solar heat but impeding its re-radiation, and to the much greater intensity of the sun's heat than we experience (nearly twice as much), the sunlit hemisphere, especially near its centre, must always be very uncomfortably warm as judged by our ideas.

We may, I think, sum up the position as regards Venus by suggesting that on this planet life may be a matter for the future rather than the present or the past; the large quantity of carbon dioxide present in the atmosphere seems to fit it for the development of plant life, which may eventually result in the setting free of oxygen and the subsequent development of animal life; and if, for any reason, the radiation of the sun were in the course of ages to undergo a marked diminution, the conditions might well be such as we are accustomed to on our earth. But in view of modern theories of stellar evolution it must be admitted that no decrease in the sun's radiation seems likely for many millions of years to come.

But I expect that most of you are more interested in Mars. Here we have to deal with the only planet (with the exception of the scorched Mercury) whose actual surface we are able to observe; and the permanency of the surface features of Mars, and the comparative ease with which they may be seen with the telescope, at once suggest an analogy with our earth, and, of course, the question of possible inhabitants. Quite apart from the permanency of the Martian features, strongly suggesting land and water, we have further similarities in his diurnal rotation, which makes his day rather more than half an hour longer than ours; and the inclination of his equator to the plane of his orbit (25° 10′, much the same as our 23° 27′), which would give rise to seasons very like ours. And we shall see presently that some very remarkable observations have at any rate lent colour to the idea that intelligent beings are present on the planet; in fact, it looks very much as though all we have to do is to supply the necessary animals and plants to provide ourselves with a beautifully complete miniature copy of our Earth.

But there are serious complications. I said just now that we have to take into account three factors when estimating the probability of life in any given locality; temperature, atmosphere, and moisture; as one might say of a "desirable residence," it must be bright and airy, and have a good water supply. Mars possesses none of these amenities. The heat received per square mile by the Martian surface is on an average less than half of that received by the earth; the atmosphere is extremely rarified, and the water supply but scanty.

That Mars possesses an atmosphere is known from the occasional obscuration of large areas of the surface, and from the photographs which have been taken in ultra-violet and infra-red light. Those taken in ultra-violet light, or even in visible light of very short wave-length, show but little detail; none, in fact, except the polar snow-caps; the rest of the disc is uniformly bright. On the other hand, photographs taken in infra-red light show all the main features usually observed visually, and in many cases accentuate the contrasts between the light and dark areas. This is just what would be expected if the planet's surface is covered by an atmosphere; light of short wave-length would be scattered by the molecules of the atmosphere and by any dust particles it contained, so that little would penetrate to the surface, the atmosphere itself being brightly lit up. Light of long wave-length, on the other hand, would be but little scattered by the atmosphere, and would penetrate freely to the planet's surface; the atmosphere would not be rendered visible, but the surface-features would—even more visible than in ordinary light.

Here it may be of interest to say that the conventional representations of the Earth, as seen from the moon or some other exterior standpoint, are very wide of the mark. They usually show the well-known outlines of the continents and seas quite clearly, as if the atmosphere did not exist; whereas it is very doubtful if more than a trace of such outlines could be seen by an observer outside it. To such an observer the earth's disc would be almost uniformly bright, and sky blue; the same colour as the sky we see on a fine day, and for the same reason; atmospheric scattering of the light of the sun. Here and there, especially near the equator, we should see the brilliantly white upper surface of clouds, indicating extensive rainy regions; and isolated cyclones, if of great extent, would similarly be rendered visible. The polar ice-caps would of course appear white, and any extensive ice-covered regions elsewhere would have the same appearance, though much confused by overlying clouds. Deserts, if practically devoid of vegetation, would be yellowish or reddish in tone, and the darkest parts of the surface would be the oceans and the great forest regions, both of which would appear dull blue. Under suitable conditions (as regards rotation) the reflection of the sun from the ocean would be by far the most brilliant thing on the planet. The outlines of continents might be dimly discerned, mainly by reason of their somewhat lighter tone, but few, if any, delicate details would be visible.

I have drawn attention to these details mainly in order to emphasise the contrast between such a view and that we have of Mars. The telescopic view of Mars, under good conditions, is crowded with detail, and the outlines of the principal markings so well-defined that it has been assumed, much too hastily, that we are dealing with oceans and continents similar to those of our Earth. But the so-called "seas" on Mars are far from uniform in colour or in darkness; darker markings are seen in them, which are in many cases continuations of markings on the lighter parts of the disc; and the "coast-lines" undergo considerable changes from year to year, even, sometimes, to the extent of being well-nigh unrecognisable. They cannot be sheets of water, especially as the reflection of the sun from these "seas," although carefully looked for at times when it ought to be visible, has never been seen; we are forced to conclude that what we have called "seas" are, in reality, extensive areas of vegetation, varying both in extent and in shape according to the Martian seasons.

The polar caps, which are usually easily seen, undergo very great and remarkably regular seasonal changes, shrinking and expanding according to the advance of summer or winter in their respective hemispheres. That they consist of snow there can be no doubt—though there seems to be very little of it; probably only enough to form a layer a few inches thick. But this means that there is a small amount of water vapour in the Martian atmosphere; though very little can be detected by the spectroscope, in fact only about one-twentieth of the proportion present in the Earth's atmosphere.

(It has been suggested that the caps may be composed of solid carbon dioxide; but this volatilizes, at low pressures, at temperatures much lower than those which the observations indicate for the polar caps.)

That the Martian atmosphere is very much less dense than ours is indicated by the ease with which the surface markings can be seen, owing to the small amount of scattering of the sun's light; it has been estimated that the atmospheric pressure at the surface is comparable with that which would be experienced at the summits of our highest mountains.

The chief interest of Mars for the "man in the street" has, for many years, centred on the so-called "canals," which have given rise to much discussion and much extravagant speculation.

In 1877 Schiaparelli, observing at Milan, detected what to his eyes were fine linear dark markings traversing the disc of the planet, in many cases joining up prominent points on the outlines of the well-known dark areas, and running almost straight for hundreds, and even thousands, of miles. These he called "canali," or "channels"; and the popular mistranslation of his "canali" into "canals" at once suggested an artificial origin for them, and, consequently, the necessary existence of intelligent and highly developed living creatures on the planet.

This idea was to a great extent encouraged by the work of an eminent American observer, the late Percival Lowell, who studied the planet for many years with first rate instruments and in a probably unsurpassed climate; and whose brilliant imagination, applied to his own observations, produced a consistent, if improbable, theory of the origin and development of these so-called "canals." To Lowell, though not to many other observers, the planet's surface appears covered with a network of fine dark lines, of thoroughly "geometrical" character, connecting with the polar snows, and serving, according to him, to carry their water, when they melt under the summer sun, far and wide across the deserts (which cover most of the surface), and thus to irrigate the Martian plantations. This highly picturesque and attractive theory cannot be said to find any very wide acceptance by other observers; not only does it require that the polar caps should be able to supply, by their melting, a quantity of water which appears most improbable in view of the appearance of the caps and their very rapid disappearance under the summer sun, but in any case the polar water could not readily flow along level canals more than 1,000 miles long, and pumping operations on a colossal scale would be required. Even if perfectly black, these "canals" would have to be at least 10 miles wide to be visible from the earth with any telescopes we possess; so that engineering operations of a most improbable character would be required to make them of any use. The changes in the visibility of these linear markings, claimed by

Lowell as confirming his theory, can be equally well explained as natural seasonal variations of atmospheric origin; so that, although a brilliant piece of constructive imagination, it has not found very general acceptance.

But the observers who see (as Lowell does) these "canali" as fine dark straight lines are in a small minority; others, of at least equal skill and experience, and using telescopes of even greater power than Lowell's in conditions in no way inferior to his, have entirely failed to confirm his interpretation, regarding these markings rather as diffuse and often wide irregular streaks of purely natural origin; and under the best conditions for seeing, these markings are often seen to be broken up into small spots or "granules," the hard, sharp, "linear" appearance being altogether absent.

It appears, then, that on Mars we have to deal with conditions hardly favourable to the existence of any highly developed form of animal life; at the most, the temperature on the sunlit hemisphere, though probably above the freezing point of water, would still be low, while during the nights it would probably be far lower than anything experienced on the earth. The Martian atmosphere appears to be very rarified and its pressure is very low; and not only would living things on Mars have to adapt themselves to a scarcity of heat, but also to a great scarcity of moisture and oxygen—possibly no oxygen at all. Vegetable life seems possible, and the observed changes in the colour and darkness of the markings make it seem rather probable; but conditions for animal life, except of the lowest description, must be very inhospitable. If there were, in the Martian atmosphere, as much oxygen as one-thousandth part of the proportion found in our own, its presence should be revealed by the spectroscope; but even this small proportion has not been detected. This would seem to bar any high forms of animal life. The redness of Mars may be due to oxidation of the surface rocks, especially if they contain much iron; this redness, together with the absence or scarcity of oxygen, seems to indicate that the rocks of Mars have devoured most of the oxygen, and that we may be dealing with an almost "dead" planet, only capable now of supporting low forms of plant life, though possibly, in the past, more suited to living things.

And now we may ask, what of other systems of planets belonging to other stars? In the first place, are there any such systems? We can have no direct visual evidence, since at the distance of even the nearest star, even our giant planet Jupiter would require, to be seen at all, a telescope of fantastic dimensions—more than 210 feet in diameter, and not in the least likely ever to be realised. But may there not be other evidence available?

At the beginning of the 19th century the great French Mathematician, Laplace, advanced the theory that our solar system was evolved from the sun itself, the planets being successively thrown off as rings by a rotating mass of gas, and afterwards condensing into the orbs we know. If this theory were correct—and it was generally accepted for nearly 100 years—there seems no reason why any and every star should not provide itself in this way with a family of planets, on some of which at any rate one might expect to find conditions suitable for the existence of living things.

But in the light of modern knowledge of mechanics, this theory is found to be untenable. In the first place, such rings as are assumed to be thrown off from the rotating parent mass of gas would not condense into single planets, but into multitudes of meteoric particles rather like the minor planets of our system; then again, the planets at the present time possess a much more rapid motion than could have been imparted to them by any original rotation that the nebulous sun might have had. (To use mathematical language for a moment, the planets possess far too much angular momentum in proportion to that of the sun; nearly 50 times as much, although their combined masses only total 1/745 of the sun's. The angular momentum of a system of bodies cannot be changed by any action *inside* the system, but only by some external force; indeed, Laplace never explained how, on his theory, the original nebulous sun was ever set in rotation at all.)

We must, then, suppose some external agency to account for the motion of the planets; and the only way in which a system of planets can have come into being now appears to be a close encounter, if not an actual collison, between two stars; resulting in the dragging out from one of them, by the attraction of the other, of a sort of "filament" of matter which would afterwards condense into small isolated masses which would gradually cool down and form the planets. Chamberlin and Moulton in America, and Jeans and Jeffreys in this country, have developed this theory along slightly different lines, and although difficulties of a mathematical nature remain, and certain peculiarities of the solar system as we know it are still unexplained, this "tidal" theory appears to be the only one at present available.

But if we consider the immense distances between the stars, compared to their diameters, and also their comparatively slow relative motion, we find that such an encounter—and still more, such a collison—must be excessively rare. Making reasonable assumptions as to stellar velocities and distances we can calculate the frequency of such encounters; and the result is, that on an average we shall find a star approaching another within the radius of the orbit of Neptune (30 times the earth's distance from the sun) only once in something of the order of a million million years!; while if we postulate an actual collision, this immense period must be further increased many thousands of times. Compared, then, to the total number of the stars, the number of planetary systems must be vanishingly small; this does not mean that there may not actually be many such systems, considering the enormous number of the stars; but it does mean that our solar system is an exception rather than the rule, and that, as far as we can see, life in the Universe is comparatively rare.

Roll of Honour.

Pilot Officer G. F. Harding gave his life May 11th, 1940. and is buried at Wesel, Germany.

Obituary Notices.

John Reed White, M.A.

Mr. White joined our Society shortly after coming to Bournemouth, which he did, on leaving Rossall School in 1919. He and Mrs. White were regular attendants both at lectures and excursions and he was, for many years, a member of Council. In 1925 he succeeded the late Mr. F. B. Taylor as Hon. Editor of the Proceedings, an office which he held until his death in January of the present year.

The Society owes to him a debt of gratitude for the skill and success with which he carried out this onerous task, seeing as he did, no fewer than sixteen of our volumes through the press. It was a source of grief to him that, owing to the financial position of the Society, the Proceedings have had to be much curtailed in recent years, but he always loyally carried out the work, keeping well within the cost which the Council felt able to devote to the publication.

Mr. White was Senior Mathematical Master at Rossall School from 1881 to 1919. The present Headmaster writes of him: "Among his out of school activities was the Photographic Society, and over the space of about a year he took quite a remarkable series of photographs of the moon through the telescope in the observatory, showing every day of its life. . . . Mr. White in his later years endowed the Rossall Antiquarian Society." The Headmaster also refers to Mr. White's ready wit, a gift which the members of our Council often had reason to appreciate and enjoy.

During his life in Bournemouth, besides our Society, Mr. White had many and varied interests. His knowledge and love of music was very great and he was a leading member of the Bournemouth Music Society, and a regular attendant at the weekly symphony concerts. He had a considerable appreciation of English literature and was an excellent and dramatic reader. As Chairman of Council of the Bournemouth Literature and Art Association he did much to foster an interest in literature in the town.

A mention must also be made of Mr. White's philanthropic work in Bournemouth. A block of three of the Eventide Homes for aged retired folk, which bears his name, is the result of his generosity. He frequently visited the Homes and concerned himself greatly with the welfare of their inhabitants.

JOHN REED WHITE, M.A.

Mr. White retained his vigour and alertness unimpaired until within a fortnight of his death, and he never allowed his advanced age to hinder his many activities.

M.P.

Constance Harriette Fryer.

The death of Miss C. H. Fryer, a much esteemed member of the Society, occurred on Wednesday, October 15th, 1941, and on the following Monday the funeral service took place at St. Stephen's Church, and was attended by many members of the Society. Miss Fryer was a regular worshipper at this Church, and was Secretary of its Parochial Church Council from November, 1921, to December, 1937.

She became a member of our Society in 1923, was a member of the Council from 1929 until the time of her death, and a member of the Garden Committee since 1930.

Possessing a wide knowledge of Field Botany in general, she was particularly interested in the Botanical Section, of which she was a very active and helpful member, scarcely ever missing any of its frequent excursions.

Sport, too, claimed some of her interest, especially golf and cricket. She was a life member of the Meyrick Park Golf Club, having in her younger days acted as Captain of the ladies' team, and she was a subscribing member of the Hampshire County Cricket Club, attending regularly the county matches played at Dean Park.

H.J.W.

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(This paper is published at the Author's request, and the Society is not responsible for the views therein expressed.)

The Primary Voltaic Cell considered as a Machine for the Liberation of both Heat and Electricity.

Abstract of a Lecture by

THE REV. M. C. POTTER, Sc. D., M.A.,
President of the Society

Emeritus Professor of the University of Durham

4th January, 1941.

> *"Consider your verdict," the King said to the jury.*
>
> *"Not yet, not yet!" the Rabbit hastily said. There's a great deal to come before that."*
>
> *"Alice in Wonderland."*

According to the usual definition a primary or Voltaic Cell is regarded as a machine which converts chemical energy into electrical energy; where chemical energy represents the free energy liberated in spontaneous or down grade chemical reactions, that is in reactions during which potential energy becomes kinetic. In a chemical reaction it will be admitted, the original bonds, both electrical and thermal, are broken and new electrical and thermal bonds are brought into existence.

Thermochemistry teaches that spontaneous reactions are exothermic and the primary cell gives evidence that these reactions are also exoelectric. In support of this contention the following reactions may be cited.

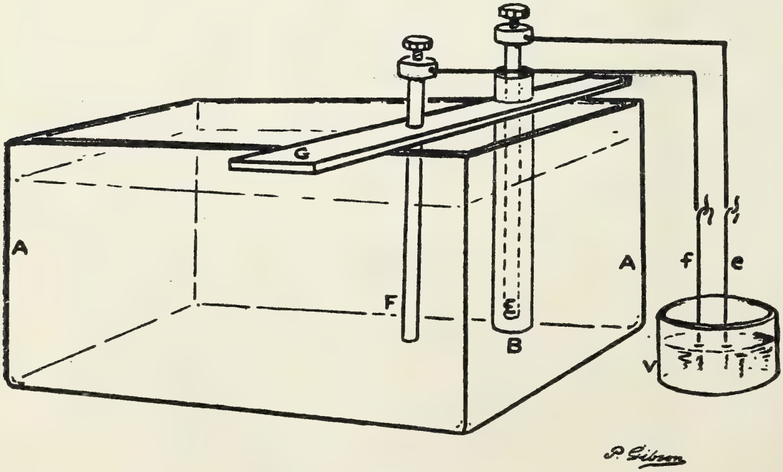


Figure 1

Fig. 1 is a diagram of a commonly described primary cell where AA is a suitable container, B a porous pot, E and F the electrodes. One of the essential conditions of such cells, as ordinarily described, is the conversion of potential into kinetic energy. This is accomplished by the interaction between one electrode, the free electrode, and the exciting liquid in which it is immersed. It is admitted that this reaction must follow the ordinary laws of chemical reactions which take place in precisely the same manner whether the reaction takes place in an open flask or in a primary cell. The reaction $Zn + 2NH_4Cl = ZnCl_2 + 2NH_3 + Elec. + Ht.$ for the Lechlanche′ and $Zn + H_2SO_4 = ZnSO_4 + H_2 + 37000cal. + Elec.$ for a zinc sulphuric acid cell are identical whether these reactions take place in an open flask or in a primary cell.

It may be said that at present the primary cell has not been described, in which heat is not made evident during the chemical actions whereby electricity is generated in the cell. So that until it is definitely established that the temperature remains unaffected during the chemical actions within the cell it can not be considered evident that the whole of the chemical energy of the cell is converted into electricity. It is known that the different forms of energy (with the appropriate apparatus) are convertable, the one into the other, in definite proportion, but it seems unknown that this change can take place spontaneously. Thus the heat generated in a primary cell is not transformed into electricity within the cell. Both the heat and the electricity can be made independently to do external work which can be shown by the thermometer and electrical instruments. It is rather that the primary cell is a machine whereby the electricity liberated during chemical or mechanical actions can be measured.

A second type of primary cell in which both the electrodes are unattackable can be illustrated by the chemical reaction which takes place between zinc and an acid (*Proc. Roy. Soc., B, Vol.* 84, 1911). Using similar carbon electrodes in figure 2 the zinc is enclosed in a glass tube open at both ends and dipping into a weak solution of sulphuric acid in the containerAA. In figure 3 the positions of the electrode and zinc are reversed so that the free electrode is placed in the glass tube and the zinc free in the dilute acid. In both these cases the zinc dissolves in the customary manner; the bubbles escaping to the surface and not from the electrode. If the circuit is open the disengaged heat and electricity dissipate into the environment, but when the circuit is closed an electric current passes through the cell.

The following reactions, carried out in the same manner as that described for zinc and acid, that is by allowing these reactions to take place in AA around the free electrode, afford experimental evidence that the free energy of the reactions is liberated partly as electricity and partly as heat and that these and other spontaneous reactions may be arranged as a primary cell.

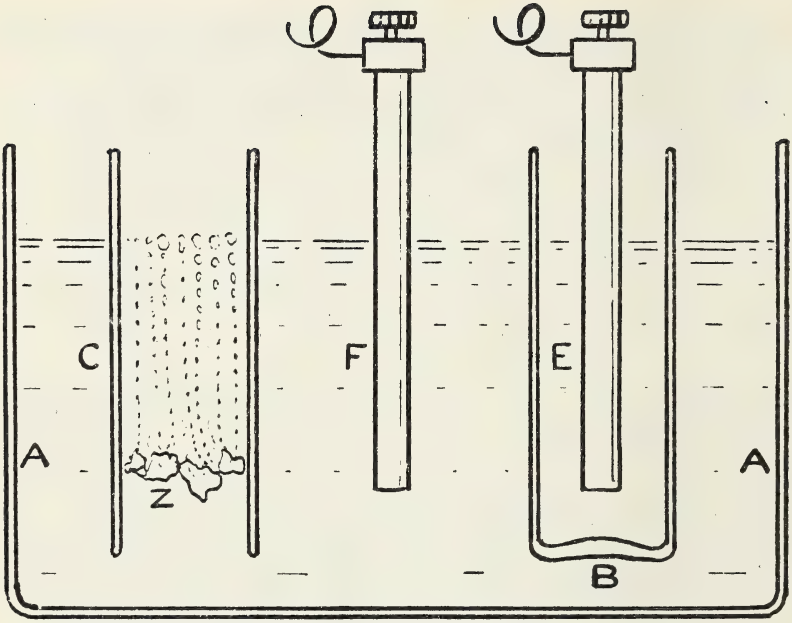


Figure 2

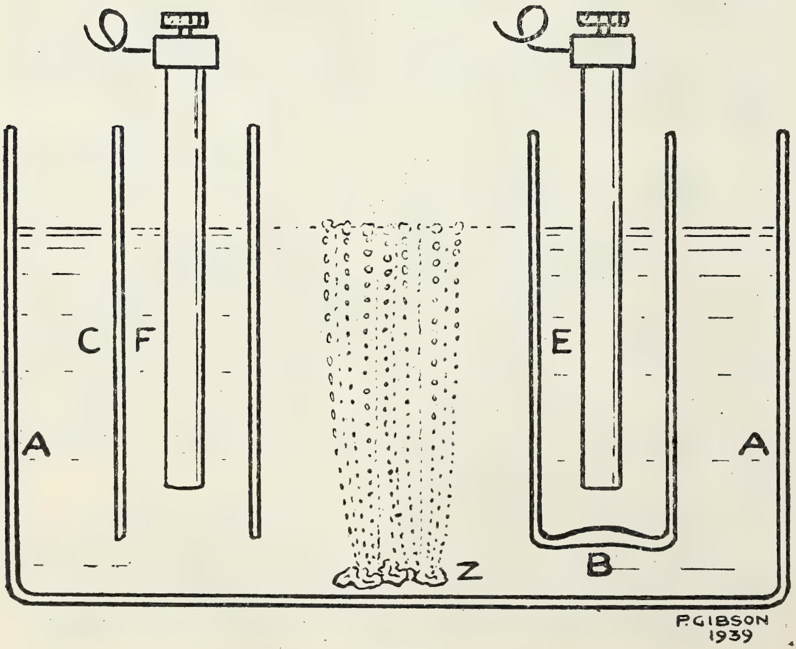


Figure 3

(1) Inversion of cane sugar.
$C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 + C_6H_{12}O_6 + 1.9$ cal. + Elec.
(2) Hydrolysis of starch
$6(C_6H_{10}O_5) + 3\ H_2O = 3\ (C_{12}H_{22}O_{11}) + 57.3$ cal. + Elec.
(3) Fermentation of sucrose
$C_{12}H_{22}O_{11} + H_2O = 4\ (C_2H_5OH) + 4(C\ O_2) + 52.3$ cal.
+ approx. 4 coulombs
(4) $Zn + H_2SO_4 = ZnSO_4 + H_2 + 37.370$ cal. + Elec.
(5) Hydrochloric acid and sodium hydroxide
$HCl + NaOH = NaCl + H_2O + 13.700$ cal. + Elec.
(6) Hydrochloric acid and washing soda
(7) Hydrochloric acid and ammonia
$HCl + NH_3 = NH_4\ Cl + 12.200$ cal. + Elec.
(8) Acetic acid and sodium hydroxide
$CH_3C\ OOH + NaOH = CH_3COONa + H_2O$
$+ 13.400$ cal. + Elec.
(9) Acetic acid and ethyl alcohol
$C_2H_5OH + CH_3COOH = CH_3COOC_2H_5 + H_2O$
+ cal. + Elec.
(10) Barium chloride and sodium sulphate
$BaCl_2 + NaSO_4 = NaCL + BaSO_4 + H_2O$ + cal. + Elec.
(11) Potassium bichromate zinc and sulphuric acid
$3Zn + K_2Cr_2O_7 + 7H_2SO_4 = 3ZnSO_4 + K_2SO_4 + Cr_2(SO_4)_3$
$+ 7H_2O$ + cal. + Elec.
(12) Decomposition of organic matter by bacteria

In these twelve reactions taken more or less at random energy is liberated within the cell partly as heat and partly as electricity, and thus one of the necessary conditions for a primary cell, the conversion of potential into kinetic energy is satisfied.

Instances in which the conversion of potential into kinetic energy without the cell may be given; by (a, fig. 4) where muscular action operates an insulated brace arranged to drill a piece of metal lying in water upon the bottom of AA; by (b, fig. 5) by stirring the water in AA either by rods of ebonite or glass or by an insulated metal stirrer; or (c, fig. 6) by allowing water to flow over pieces of broken glass placed in a large glass tube. In these three instances both heat and electricity are generated, the former shown by the thermometer and the latter by electrical instruments. In other words electricity proportional to the work done is continuously generated during these operations; which can be estimated by a coulometer which gives a method by which the force expended in muscular action can be estimated; or (d, fig. 7) in this case the external energy is derived from a battery (X) which causes an electric current to pass along a thin wire (Y) immersed in the water in AA. This current both heats the thin wire and produces an electric field in the water surrounding it, and thus brings into action a primary cell when the battery circuit is closed. This electric field is continuous and not momentary, shown by the gradual electric deposit in a coulometer as long as the battery is closed (*Proc. Bournemouth Nat. Sc. Soc., Vol.* 31, 1938-9.) Other examples of this type of primary cell may be given (1) by lowering a piece of hot (black) iron, suspended by an insulated wire, into the water in AA; (2) a photo electrical cell by employing a glass transparent container for AA and an ordinary Lechlanche′ porous pot. Thus the free electrode is exposed to light while the electrode E is kept in darkness. In both these instances an electric current in sympathy with the arrangement passes through the cell when the circuit is closed. At present no researches upon the action of the different wave-lengths of ordinary light have been possible, but the same results were noted, when the apparatus was enclosed in a large rhubarb leaf. Thus it would seem that the electric potential between the different parts of a plant is influenced by their illumination. Hence the exposure of a leaf, or a group of cells or even a single cell to the light would induce potential differences in these structures which might be a factor in photosynthesis (*see Waller, Californian Lectures. Physiology the Servant of Medicine*); and (3) when a gas (air) or the negative electrical breath (*Bio-Elec. Potentials*) is forced by external work through the water in AA (*Lord Kelvin, Proc. Roy. Soc., Vol.* 57, 1895) causing bubbling then when the circuit is closed an electric current passes through the cell. By this arrangement the work done in these three instances can be measured by means of a coulometer.

A rather different type of primary cell is given by the decomposition of an ordinary garden compost heap (*Zent. f. Bakt., Parasit. u. Infektion. Abt.* 2, *Bd.,* 78, 1920; *Bd.* 84, 1931; *Bd.* 90, 1934; *Bd.* 93, 1935. *Proc. Bournemouth Nat. Sc. Soc., Vol.* 31, 1938-9, *Vol.* 32, 1940), employing a similar pair of unattackable electrodes, one placed in the heap and the other in the soil at a little distance from the heap. When leads from these electrodes are placed in a copper coulometer, then an electric current passes through the system. By removing the soil electrode to a greater or less distance from the heap it would appear that the electric current between the electrodes varies as the inverse square of the distance of the soil electrode from the heap.

The potential difference between a plant and its environment (soil) may be shown by fig. 8 and fig. 9. Similar unattackable electrodes used in pairs, being used in both instances. In the former one electrode is inserted in the plant and the other in the soil; when leads from these electrodes are taken to a solution of copper sulphate in a glass vessel resting on the soil and in the latter when the lead from the electrode inserted in the plant is taken by the copper lead (D) to a solution of copper sulphate in a porous pot buried in the soil. Then an electric current proportional to the

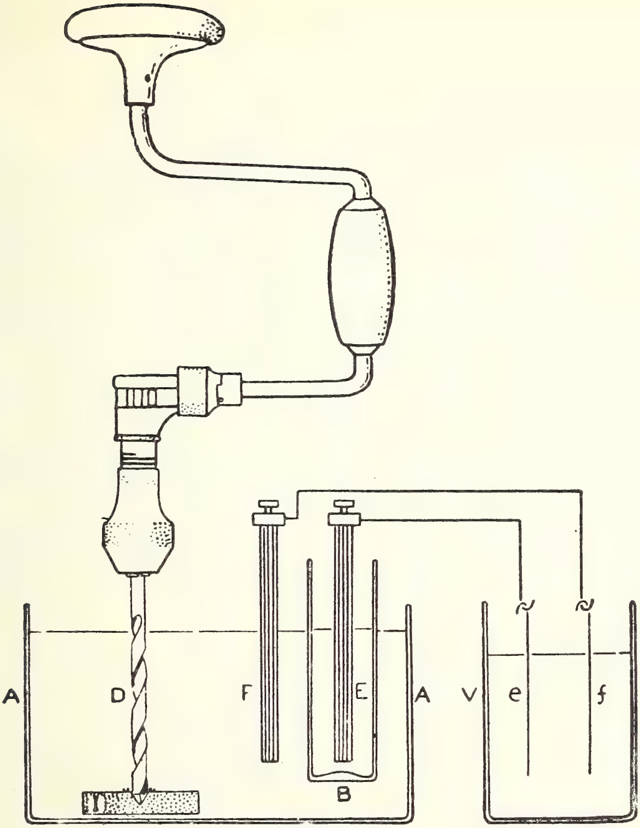
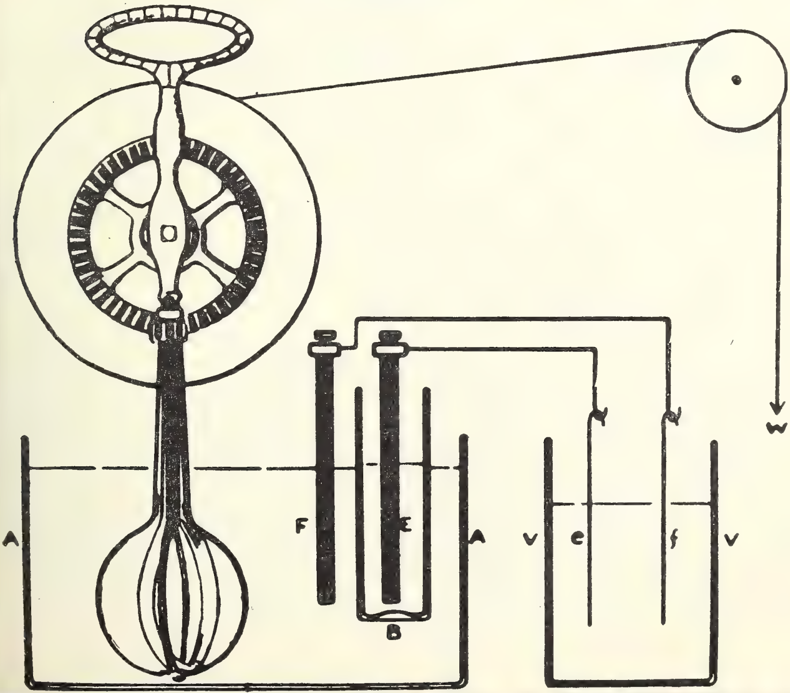


Figure 4



metabolic activity of the plant and the electricity liberated by the soil microorganisms in the environment of the roots of the plant passes through the system as evidenced by the electrical deposit of copper upon the wire D immersed in the copper coulometer.

The accepted theory, due to Rumford, that heat is motion seems to rest upon two assumptions. (1) That the supply of heat is inexhaustible depending only upon the work done during his experiments. It may be said that experimental proof is wanting in confirmation of this assumption. The well-known experiment that a piece of iron, by hammering, can be raised to a red heat is often quoted. But the sequel that the same piece of iron cannot be raised a second time by hammering to a high temperature unless it has been placed in the forge appears to have escaped notice. (2) That the whole of the work employed in the determinations of J is converted into heat. This assumption, it may be suggested, is not in accordance with the experiments cited above.

According to the mechanical theory of heat the atoms and molecules of a body are in a state of motion which Clerk Maxwell considered to be an impossible condition. On this theory the temperature of a body depends upon the vibration of its constituent particles. It may be remarked that the structure of a metal so vividly revealed to us by our late President, Sir Harold Carpenter, and the intimate knowledge of molecular structure given to us through the work of Sir Willam Bragg and others show that such a state of motion does not exist. May it be said that these researches are not in harmony with the conception that heat is motion and show as H. L. Callendar remarks (*Pres. Address Phys. Soc. , London, Vol.* 23, 1911) that the caloric theory is not "really quite so illogical as it is generally represented to be," and alleges that it was not realised in 1850 that "the quantity measured in an ordinary calorimetric experiment is the motive power of energy of the caloric and not the caloric itself. He also has shown that the entropy of Clausius is identical with the caloric of Carnot. In justice to Carnot this should be admitted. Callendar further remarks that Carnot's caloric makes its appearance in the mechanical theory.

The generally accepted constitution of a body shows that the special properties of latent, specific, and atomic heat are its definite characters at the same time its temperature may be subject to variation due to conditions of environment. In a corresponding manner it may be suggested that atomic electricity may be predicted and also it is recognised that the electricity potential varies in sympathy with environment. Thus it may be inferred free heat (temperature) and also fixed or bound atomic heat (entropy or caloric) are the essential conditions of any substance. The electron theory of matter leads to the supposition that atomic electricity in addition to electric potential may also be an

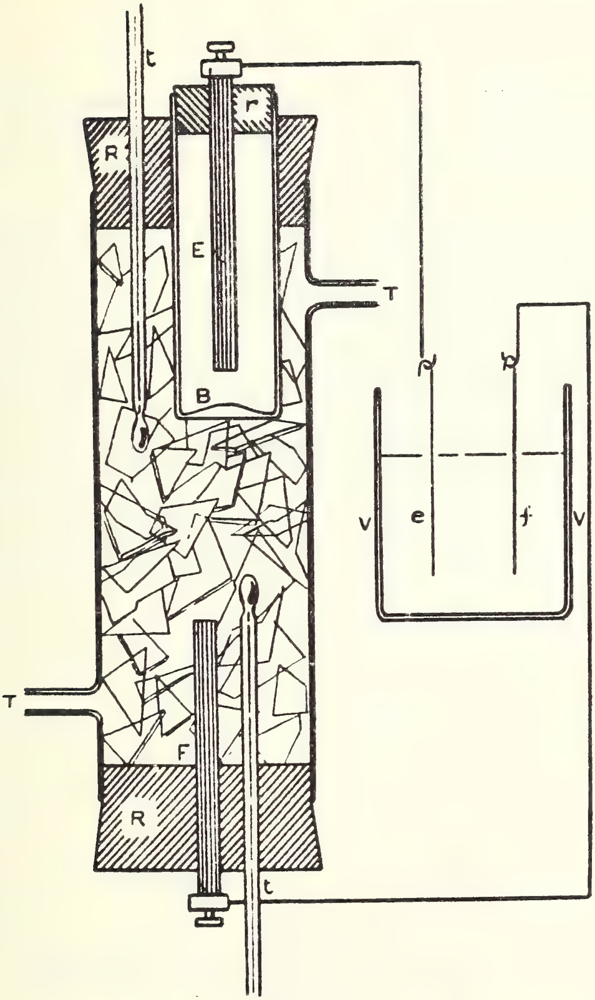


Figure 6

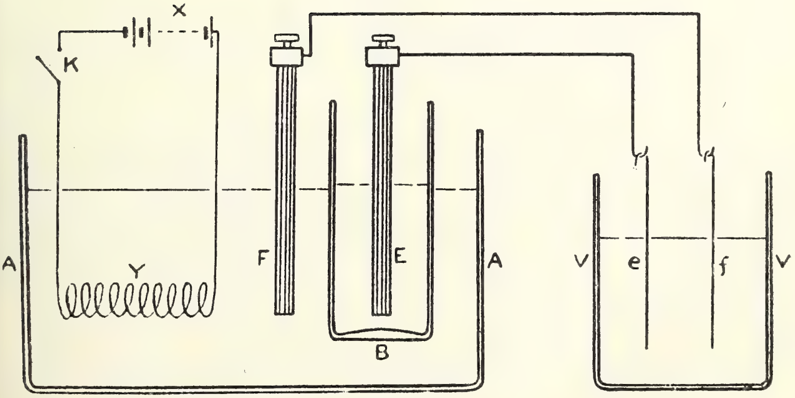


Figure 7

essential condition. On this suggestion it would seem that the free heat and free electricity are liberated by friction and the atomic heat and atomic electricity are liberated by chemical reactions.

In the experiments by Pictet (*Essais de Physique, Experiences sur la chaleur produite par le frottement, Ch. IX; Geneva,* 1790) and also by Dr. Gilbert the temperature of the ebonite and of the cat skin is raised as shown by a thermometer, simultaneously with their electrification. Thus the work of rubbing one substance against another is divided between the generation of heat and the generation of electricity. Also according to the condition of the surrounding medium the ebonite and the cat skin may cool down to its temperature while retaining their electricity charge, and vice versa these bodies may loose their electricity charge while retaining a higher temperature. Similarly when a piece of metal is rubbed the rise of its temperature, depending upon the work of rubbing, is identical whether the metal is earthed or insulated. These experiments indicate that electricity

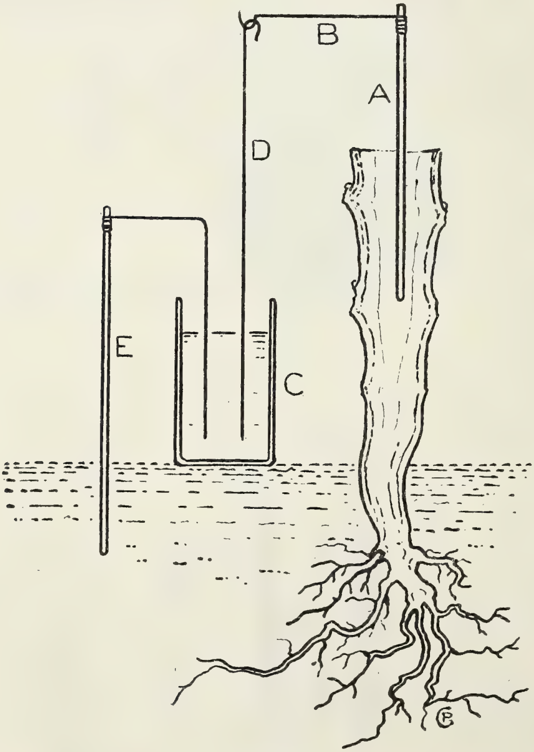


Figure 8

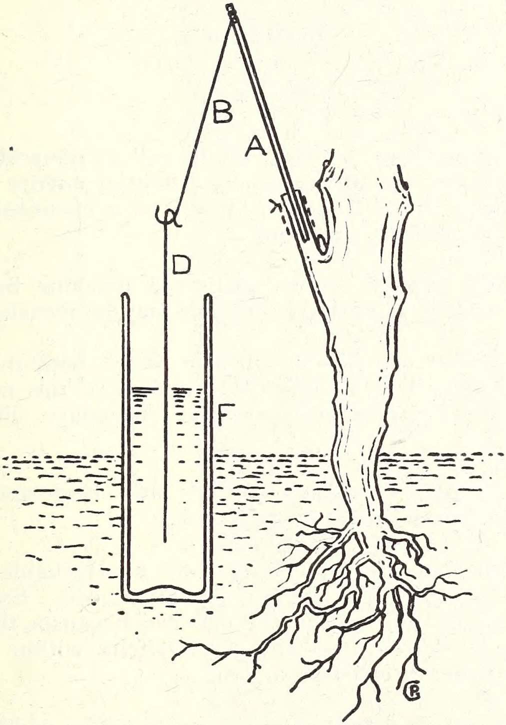


Figure 9

and heat are distinct and independent entities and do not, as previously remarked, spontaneously change the one into the other.

So far experimental data show that the simultaneous generation of electricity and of heat always accompanies the friction between solids, between a solid, a liquid and between a solid and a gas.

Criticism has been offered that the electricity generated in these experiments might be due to differences of oxidation or differences of electrolytic pressure between the electrodes; but it may be remarked if such were the case then any such inequality between the electrodes would be primarily due to the work employed in the experiments. Any such difference, if existant, between the electrodes and their environment can be obliterated or reduced to a minimum by wrapping the porous pot and free electrode with several folds of cloth. It is found that the electricity is generated, as before, under these conditions.

SUMMARY.

A condition of the primary voltaic cell as generally described is the liberation of energy whereby potential energy is rendered kinetic. This is accomplished by means of a chemical reaction in which one electrode is concerned.

A primary may be considered as a machine by which the electricity liberated in various reactions may be measured.

Primary cells can be described in which both the electrodes are unattackable, but a chemical reaction in the medium surrounding one electrode provides the necessary liberation of energy.

The liberation simultaneously of both heat and electricity seems to take place in the primary cell.

The "Mechanical Cell" with two unattackable electrodes, but without any chemical reaction within the cell. External work provides an excitation within the cell which causes the liberation simultaneously of both heat and of electricity within the cell and thus calls a primary cell into action.

A variety of chemical reactions are given by which a primary cell can be called into action.

The simultaneous liberation of both heat and electricity is shown to be independent of the type of apparatus employed.

Experimental data show that a considerable portion of the work, employed in the determination of J, is converted into electricity.

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